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NUMBER 1

United States Naval Medical Bulletin

PUBLISHED *for the* INFORMATION OF
MEDICAL DEPARTMENT *of the* NAVY



THE MISSION OF THE MEDICAL CORPS OF THE NAVY

**TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**

Issued Quarterly by the Bureau of Medicine and Surgery
Washington, D. C.

Vol. XXXV

JANUARY 1937

No. 1

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED QUARTERLY FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY



Issued by

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NAVY DEPARTMENT



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Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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1937

TABLE OF CONTENTS

	Page
PREFACE.....	v
NOTICE TO SERVICE CONTRIBUTORS.....	vi
SPECIAL ARTICLES:	
THE TREND OF VENEREAL DISEASE IN THE UNITED STATES FLEET. By K. C. Melhorn, Captain, Medical Corps, United States Navy.....	1
HUMAN YAWS. By C. S. Butler, Rear Admiral, Medical Corps, United States Navy.....	6
PRESENT DAY CONCEPTS OF ENDOCRINOLOGY. By Paul F. Dickens, Lieutenant Commander, and Omar J. Brown, Lieutenant, Medical Corps, United States Navy.....	8
ACTIVE IMMUNIZATION AGAINST TETANUS WITH TETANUS TOXOID. By W. W. Hall, Lieutenant Commander, Medical Corps, United States Navy.....	33
THE NAVY AND APPENDICITIS. By Lucius W. Johnson, Captain, and Horace R. Boone, Com- mander, Medical Corps, United States Navy.....	41
THE SPECIALIST VERSUS THE NAVAL SURGEON. By George F. Cottle, Captain, Medical Corps, United States Navy.....	52
AVIATION MEDICINE. By John W. Vann, Commander, Medical Corps, United States Navy.....	55
AN EVALUATION OF A MODIFIED SCHAFER METHOD OF ARTIFICIAL RESPIRATION. By F. S. Johnson, Commander, Medical Corps, United States Navy, and J. A. Hawkins, D. Sc., and O. D. Yarbrough, Lieutenant, Medical Corps, United States Navy.....	60
— THE USE OF OXYGEN IN THE TREATMENT OF COMPRESSED-AIR ILL- NESS. By Albert R. Behnke, Lieutenant, junior grade, Medical Corps, United States Navy, and Louis A. Shaw, from the Department of Physiology, Harvard School of Public Health, Boston, Massachusetts.....	61
PATHOLOGICAL FRACTURES. By Foster H. Bowman, Lieutenant Commander, Medical Corps, United States Navy, retired.....	73
CLINICAL NOTES:	
A CASE FOR DIAGNOSIS.....	81
SARCOMA OF THE SKIN, MALIGNANT GLOMIOID TUMORS. By Albert Soiland, Commander, Medical Corps, United States Naval Reserve.....	85

SUGGESTED DEVICES:

A NEW FIRST AID EMERGENCY OUTFIT.

Page

By C. B. Camerer, Captain, Medical Corps, United States Navy,
and Chief Pharmacist's Mate H. Z. Dudley, United States
Navy.....

87

NAVAL RESERVE.....

89

NOTES AND COMMENTS:

The Twelfth Surgeon General, United States Navy—American College
of Surgeons and College of Physicians—A Case For Diagnosis—
Control of Syphilis—Olive Oil as an Antidote in Phenol Poison-
ing—Iso-Elixir—Lead in Body Fluid—Tracheobronchitis.....

95

BOOK NOTICES:

Syphilis, Hinton—Basal Metabolism, Dubois—Psychiatry, Sadler—
Mayo Clinic Volume—Heart Disease, Levine—Vascular Disorders
of the Limbs, Lewis—Endocrinology, Wolf—Art of Treatment,
Houston—Hygiene and Sanitation, Price—Eye, Ear, Nose, and
Throat, Parkinson—Food-Born Infection, Tanner—Exophthalmic
Goiter, Bran—Preventive Medicine, Boyd—Obstetrics, Williams—
Diseases of the Eye, Berens—Materia Medica and Pharmacology,
McGuigan—Microbiology and Pathology, Carter—Oral Hygiene,
Bunting—Radiodontia, Thompson—Disinfection and Sterilization,
McCulloch—The Patient and the Weather, Petersen—Chemical
Procedures, Mattice—Psychological Medicine, Gordon—Lehrbuch
Der Militarhygiene, Waldmann, Hoffmann—Materia Medica and
Therapeutics, Parker.....

101

PREVENTIVE MEDICINE:

TOXIC EFFECTS OF ARSENICAL COMPOUNDS EMPLOYED IN THE
TREATMENT OF DISEASES IN THE UNITED STATES NAVY, 1935.

By C. S. Stephenson, Commander, Medical Corps, United States
Navy, and E. H. Wingo, Chief Pharmacist's Mate, United
States Navy.....

111

HEALTH OF THE NAVY—STATISTICS.....

150

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, and reports from various sources, notes, and comments on topics of medical interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

P. S. ROSSITER,
Surgeon General, United States Navy.

▼

NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated, if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received at least 3 months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

THE TREND OF VENEREAL DISEASE IN THE UNITED STATES FLEET

By K. C. MELHORN, Captain, Medical Corps, United States Navy

Pronounced by Parran as "one of the outstanding public health accomplishments of our generation; * * * a modern miracle in medicine" (1) the control of syphilis in Sweden has become so effective that the disease is no longer a major health problem. According to Rietz, the Commissioner of Health, Stockholm, the rate for new cases has dropped from 4.4 per 1,000 in 1919 to 0.2 in 1935 (but 431 new infections in a population numbering more than 6,000,000). (2)

The full significance of this remarkable achievement is appreciated when one contrasts it with the 11,000 reported last year for upstate New York of approximately the same population or the current rate in the United States as announced by Usilton: "Annually there are 4 per 1,000 individuals in the United States with a fresh syphilitic infection and 8 per 1,000 with acute gonorrhea who seek authorized medical care." (3) In short 518,000 cases of early syphilis and 1,037,000 cases of acute gonorrhea—a total of 1,555,000 fresh infections of venereal disease a year.

The methods employed in Sweden are of interest to all medical officers, especially those who believe in the medical control of prostitution. Rietz reports them in brief as follows:

Two points form the basis for the Swedish legislation against venereal diseases:

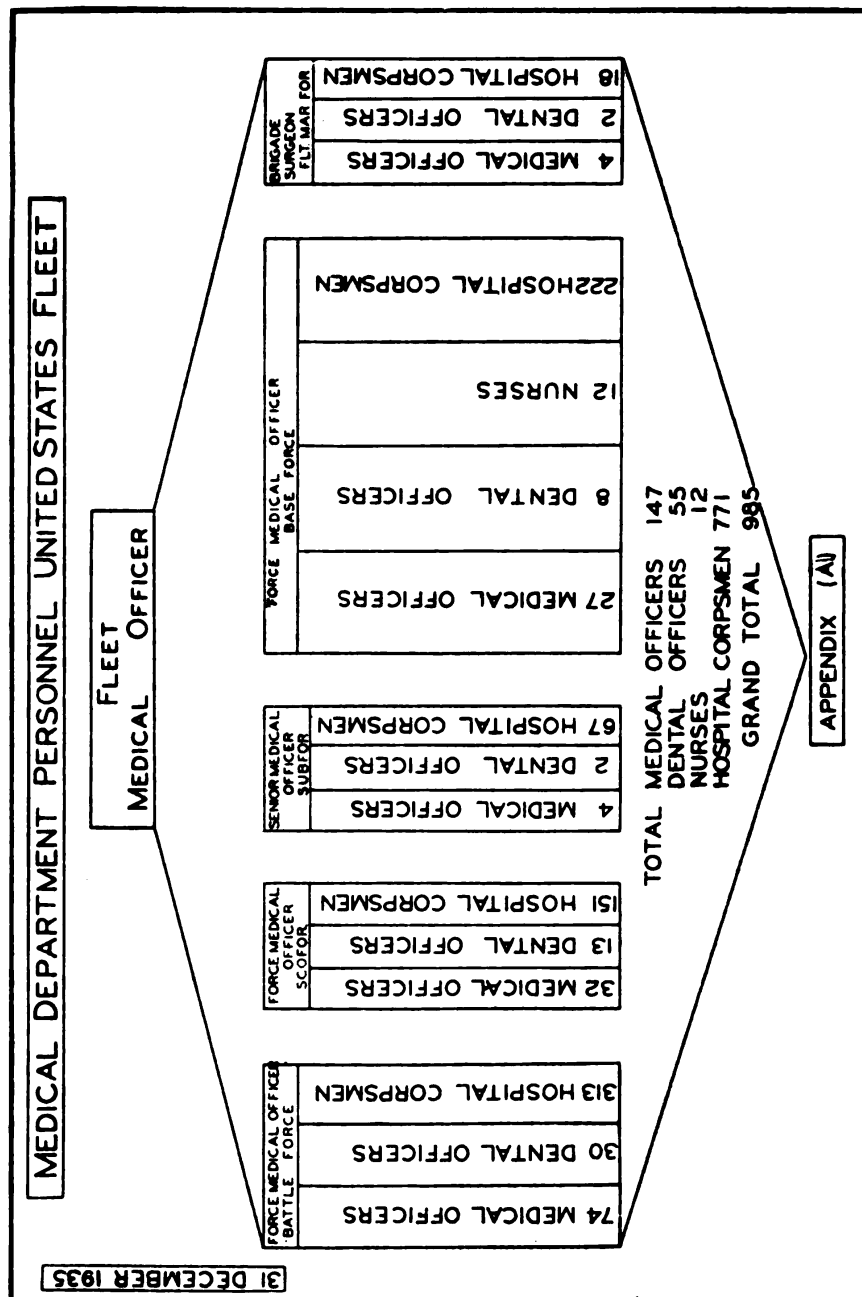
First: The search for and detection of the source of infection as in other contagious diseases.

Second: Though personal liberty is safeguarded in Sweden at least as carefully as in America, the law imposes a very definite restriction of freedom upon persons afflicted with venereal disease, compelling them to accept an amount of medical treatment, not according to their own choice, but according to the decision of responsible physicians. Upon individuals, under such control and to whom complete medical facilities for treatment are available at no cost, the nation further imposes the responsibility not to propagate the disease. For willful neglect of this responsibility, punishment up to the severity of forced labor can be imposed.

The results correspond to the ability of medical science of today in the treatment of these diseases: For syphilis the results are even better than could have been hoped for, but for gonorrhea decidedly poorer. It is believed that considerable further decrease in the frequency of gonorrhea might be obtained by better methods for treatment in order to get the patient noninfectious in a shorter time and by procedures of individual prophylaxis.

Thus we have successfully applied to the combating of the venereal diseases the experience and principles gained in epidemiology, medicine, and public health administration. (2)

In the control of communicable disease early notification of cases is the first essential. In military parlance a sound estimate of the situation necessitates careful reconnaissance. Parsons in his illumi-



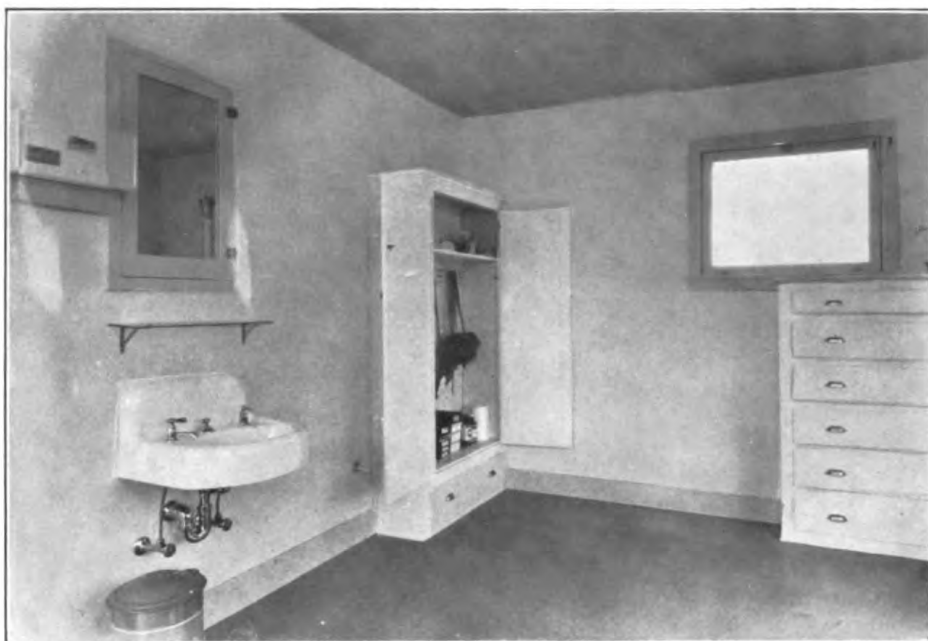
nating and much-quoted article "Syphilis in the Navy" undoubtedly had this aspect of the subject in mind when he stated: "If we take stock of our * * * statistics in these matters and subject ourselves to some rigid and critical self-examination, the effect of turning on the light should be a wholesome one." (4)



NAVY FIRST AID AND PROPHYLACTIC STATION, SAN PEDRO, CALIF.



OFFICE OF FIRST AID AND PROPHYLACTIC STATION, LONG BEACH, CALIF.



FIRST AID ROOM OF NAVY FIRST AID AND PROPHYLACTIC STATION, SAN PEDRO, CALIF.



VENEREAL PROPHYLACTIC CUBICLES OF NAVY FIRST AID STATION, SAN PEDRO, CALIF.

To the end that early notification of new cases of venereal disease will become an established practice in the fleet, the commander in chief on January 21 of this year (1936) issued the following directive:

CinC File No. P3/(433)

75-WCP(0)

UNITED STATES FLEET,
U. S. S. NEW MEXICO, FLAGSHIP,
San Pedro, Calif., January 21, 1936.

From: Commander in Chief, United States Fleet.

To: Fleet.

Subject: Venereal Diseases—monthly report of.

Reference: (a) General Order no. 14 of 13 May, 1935.

1. Commanding officers requiring monthly reports by medical officers on the sick days and noneffective rate resulting from venereal diseases in each division are provided with an informative index of the success or failure of measures employed to combat this menace. Highly effective use can be made of these data in measuring the extent of infection and in determining trends.

2. Information of this nature being especially valuable to fleet and force commanders, reports listing the following data will be forwarded monthly to the commander in chief by each commanding officer—a copy being supplied to the respective force commander:

- (A) Average complement for month.
- (B) Total sick days (all causes).
- (C) Total sick days resulting from venereal diseases. (Class XII—U. S. Navy nomenclature.)
- (D) Noneffective rate (computed as follows: *Sick days (venereal diseases) X 1,000 average daily strength X days in period*).
- (E) Number of prophylactic treatments ashore as reported by senior patrol officer.
- (F) Number of prophylactic treatments aboard ship.
- (G) Number of new cases of gonococcus infection, urethra (original admissions).
- (H) Number of new cases of chancroid (original admissions).
- (I) Number of new cases of syphilis (original admissions).
- (J) Comment as indicated.

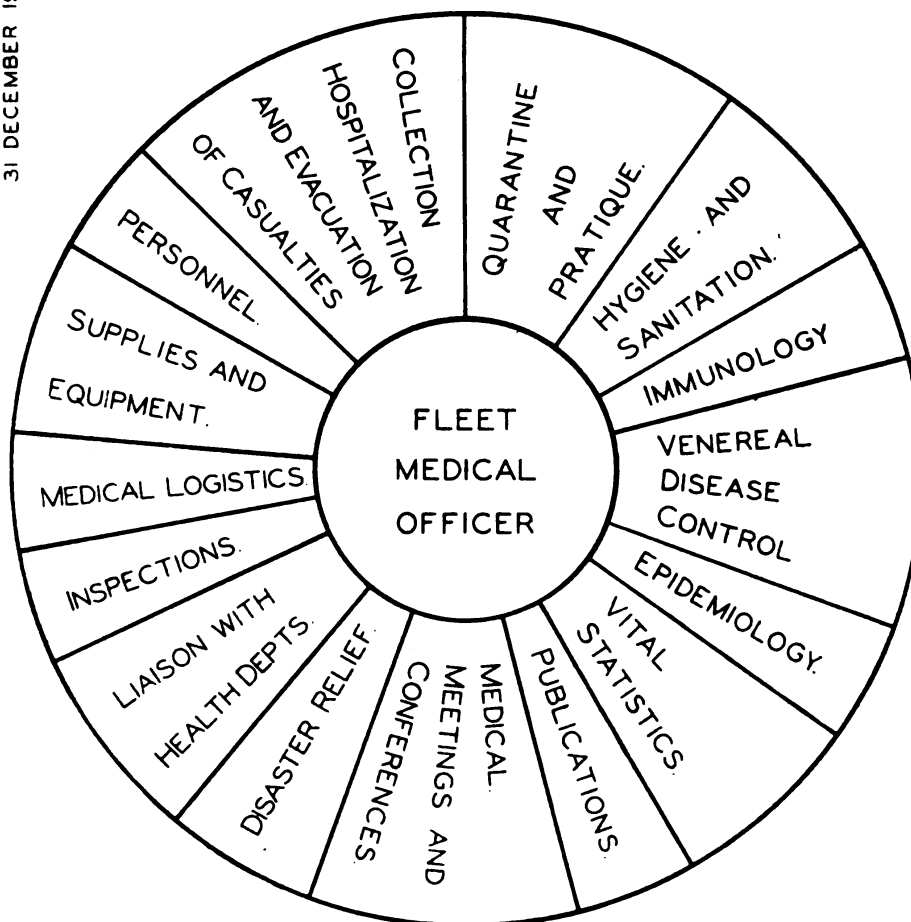
3. The initial report will be submitted for the month of January 1936.

J. M. REEVES.

Monthly the data required by this order are charted and analyzed in the fleet medical office and monthly the command is informed of the trends revealed. At the end of each quarter, summarized data listing each ship by name are the subject of a special fleet bulletin. The releases covering the period January 1 to June 1, 1936, included the following information:

31 DECEMBER 1935

DUTIES OF FLEET MEDICAL OFFICE



APPENDIX- (B)

TABLE I.—*Type and fleet rates compared*

[Period Jan. 1 to Mar. 31, 1936 inclusive]

Type	Average complement	Gonorrhoea	A. R. P. 1,000	Chancroid	A. R. P. 1,000	Syphilis	A. R. P. 1,000	Total new cases	A. R. P. 1,000
Battleships.....	18,953	310	65.7	33	6.9	53	11.2	396	83.8
Carriers.....	7,224	76	42.1	8	4.4	18	10.1	102	56.6
Carriers (Ca. & Cl.).....	13,416	199	72.1	10	3.6	29	10.4	238	96.1
Destroyers.....	10,055	104	41.4	17	6.7	18	7.3	139	55.4
Submarines.....	3,345	16	19.1	3	3.5	7	8.5	26	31.1
Auxillaries.....	10,132	103	40.7	9	3.5	24	9.6	136	53.8
U. S. Fleet.....	63,125	808	51.3	80	5.0	149	9.5	1,037	65.8

For comparison table II is of interest.

TABLE II.—*Original admissions*

	U. S. Navy (5)		U. S. Fleet
	Rate per 1,000 1929-33	Rate per 1,000 1934	Rate per 1,000 Jan. 1 to Mar 31, 1936
Gonorrhoea.....	74.67	56.07	51.3
Chancroid.....	27.56	13.58	5.0
Syphilis.....	24.80	20.59	9.5
Total.....	127.03	90.24	65.8

The significance of these rates may be better appreciated by comparing them with the following data recently compiled by L. J. Usilton, United States Public Health Service and published under the caption "Trend of Syphilis and Gonorrhea in the United States" in Venereal Disease Information of May 1935:

"Annually there are 4 per 1,000 individuals in the United States with a fresh syphilitic infection and 8 per 1,000 with acute gonorrhea who seek authorized medical care. There is also an additional 4 per 1,000 who are admitted to treatment for the first time after their syphilitic infection has become late and 4 per 1,000 admitted for treatment with chronic gonorrhea."

TABLE III.—*Prophylactic rate, U. S. Fleet*

	Average comple- ment	Number prophy- laxes ashore	Rate per 1,000	Number prophy- laxes aboard	Rate per 1,000	Rate per 1,000 aboard and ashore
January.....	62,668	440	7	7,137	114	121
February.....	63,770	493	8	7,606	119	127
March.....	62,937	500	8	7,478	119	127
Total.....	189,375	1,433	8	22,221	117	125

It will be noted that the prophylactic rate ashore shows virtually no change during the 3 months; the total combined rate varying only from 121 to 127.

The importance of maintaining adequate first-aid and prophylactic service as an essential of shore patrol activities is again emphasized by revealing figures covering the fleet concentrations at Panama, May 9 to 16 and May 23 to 26, 1936. The average number of personnel receiving prophylaxis ashore was 300 per day—the average complement of fleet present ranging from 50,000 in the first period to 27,750 in the second. The prophylaxis rate ashore in May increased 5 plus times and became 42 per 1,000.

The extent and effectiveness of the prophylactic measures employed ashore and afloat during the recent fleet concentrations at Panama are in evidence as follows:

TABLE IV

[Periods of January-April and May 1936, compared for ships visiting Panama¹]

	Average comple- ment		Total prophylactic treatments				A. R. per 1,000 (new cases of venereal dis- ease)	
			Ashore		Aboard			
	Jan.- Apr.	May	Jan.- Apr.	May	Jan.- Apr.	May	Jan.- Apr.	May
9 battleships.....	10, 916	11, 255	286	1, 264	4, 104	1, 822	93	34
4 carriers.....	4, 673	6, 018	100	570	1, 914	601	81	39
6 cruisers.....	3, 025	3, 117	17	228	780	282	67	18
6 submarines plus <i>Holland</i>	970	1, 466	0	29	265	106	13	24
39 destroyers.....	4, 175	4, 282	6	242	2, 805	733	67	44
13 auxiliaries.....	3, 442	3, 340	59	395	1, 660	438	67	42
Total.....	27, 201	29, 477	468	2, 728	11, 528	3, 962	66	35

¹ Units which did not return to Panama for the period May 23 to 26, 1936, are not included.

New prophylactic stations.—In order to obtain a ready acceptance of venereal prophylaxis it is necessary that the facilities be planned, equipped and maintained in accordance with modern standards of surgical cleanliness. To this end new first-aid and prophylactic stations, equipped with straddle stands, toilets, knee-action lavatories (hot and cold water), soap dispensers, electric sterilizers, waste receptacles, glass shelving and tiled floors, have been erected and placed in commission at the Navy landings of Long Beach and San Pedro, Calif.

Educational sound-motion picture.—Seven (7) prints of the sound-motion picture "Science and Modern Medicine", an instructional film dealing with the prevention and control of venereal disease, are being purchased by the Bureau of Navigation for distribution to all naval training stations and to the forces afloat. Two (2) of these prints will be circulated in the fleet within the near future.

CONCLUSION

In the promotion of effort to solve the Navy's most serious health problem, accurate and early knowledge of the number of new cases of venereal disease is the first requisite. To provide informative indexes of the success or failure of control measures, periodic appraisal reports are recommended for adoption by every command ashore and afloat. District medical offices in particular, would render valued service to the fleet, to city and to State health authorities by active participation in such a program.

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- (1) Parran, T., Jr. Discussion of Rietz's article, *Am. Jour. Pub. Health*, 26, 4, 1936.
- (2) Rietz, E. The Prevention of Venereal Diseases in Sweden, *ibid.*
- (3) Usilton, L. J. Trend of Syphilis and Gonorrhea in the United States. *Ven. Dis. Inform.* 16, 5, 1935.
- (4) Parsons, R. P. Syphilis in the Navy. *U. S. Nav. Med. Bull.* 32, 4, 1934.
- (5) Statistics of Diseases and Injuries in the United States Navy for the Calendar year 1934.

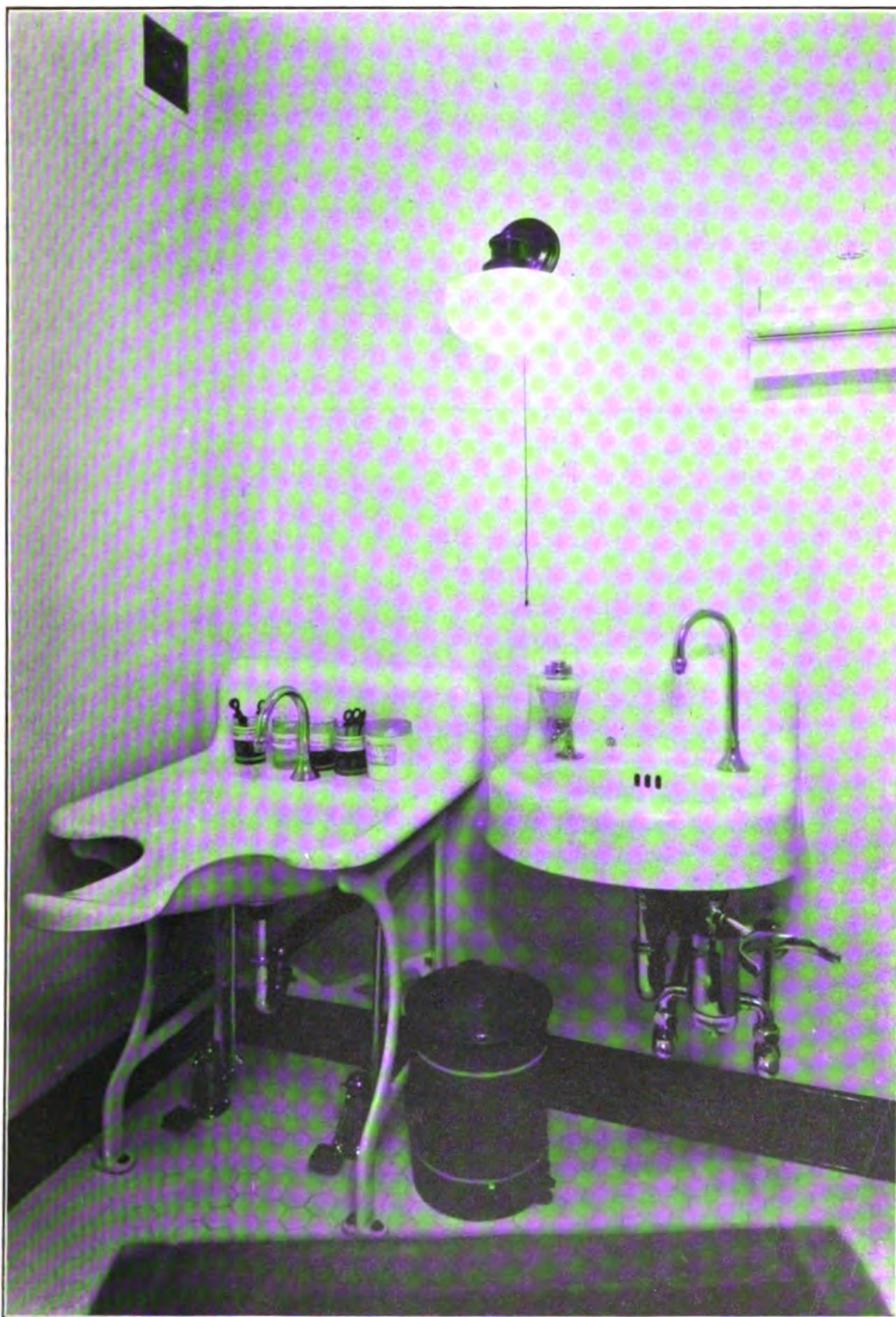
HUMAN YAWS

By C. S. Butler, Rear Admiral, Medical Corps, United States Navy

There is nothing in human medicine which can equal the flexibility of experts on yaws in adjusting their dilapidated point of view to the body blows their thesis has received from advocates of unity. One of the latest and perhaps most humiliating of the assertions they have had to retract is that regarding immunity to syphilis of patients suffering from so-called yaws.

For some 75 years frambesia experts have found it easy to inoculate human beings suffering from syphilis with yaws so-called. It is recalled that not only in human beings but also in monkeys (Schöbl) was it a simple matter to infect with each of the supposedly different viruses.

In the Report of the International Health Division of the Rockefeller Foundation for 1935, page 124, we are shocked to find that in Jamaica



STRADDLE STAND CUBICLE OF NAVY FIRST AID AND PROPHYLACTIC STATION,
SAN PEDRO, CALIF.

and also in Samoa representatives of the International Health Board have discovered that: "Syphilis also confers immunity to yaws which is as great as, if not greater than, that conferred by yaws itself." This taken with Prof. Carl Weller's findings in yaws aortas (1) that there are no pathological differences to be noted, makes us wonder why the "yaw men" still persist in their plea. The ground has been cut from under them at all points.

However, as an entity yaws never *did* have a leg to stand on. Created originally as the *ipse dixit* of a man who had never been in the tropics, where alone yaws was supposed to exist, it has been kept alive by the fighting qualities of its partisans.

Now that the last possible difference between the virus of syphilis and of yaws has vanished into thin air, it will be interesting to see what device frambesiologists will resort to in order to make the "carcass appear to be alive." Begging the question will no longer serve. Their assertion that yaws is never congenital should be revised, if they wish it to express the truth, so as to read "yaws is usually congenital."

Within a few months of the time the United States took over Guam, Passed Assistant Surgeon B. R. Ward, United States Navy, reported (Report of the Surgeon-General, U. S. Navy, for 1899, pp. 203 and 204) "Syphilis, especially in the tertiary forms, is very common in Guam. Its ravages are terrible * * *. The bodies of some of them (the natives) are simply one putrescent pultaceous mass without recognizable features."

In the Report of the Surgeon-General, United States Navy, for the year 1900, pages 208 to 212, inclusive, Philip Leach, surgeon, United States Navy, renders a Sanitary Report on Guam, Ladrone Islands. In this report Surgeon Leach says:

The syphilitic cases are probably almost all hereditary. No cases of primary or secondary syphilis have been seen, and of the 127 cases treated not one gave a history of primary or secondary symptoms. It is not uncommon for more than one generation to be under treatment simultaneously. Ulcers, gummata, and joint and bone lesions, many of which have been very destructive, are the chief types. A few instances, however, of syphilis of the central nervous system have been seen. The extraordinary success attending the treatment of these unfortunates has been most gratifying. Excepting the paralytic cases, all have responded promptly to the appropriate treatment. And it matters not whether mercurials or potassium iodide, or both, be employed, or whether the dose be large or small, the same rapid results are obtained. It is safe to predict that, could all districts of the island receive the benefits of this treatment, the lesions that now too commonly offend the eye and nose of the traveller, would in a very few years entirely disappear.

The Navy experience in Guam cannot be "laughed off" by the yaws experts—it will be good a thousand years hence.

We can state the case for Guam by using a syllogism, thus:

A—Any people who cannot contract venereal chancres are already infected with syphilis.

B—The people of Guam do not contract genital chancres.

C—Yaws (the chief disease of the Island) immunizes the human being to venereal chancres.

D—Therefore yaws is syphilis.

REFERENCE

- (1) The Pathology of the Aorta in Haitian Treponematosi, by Carl V. Weller, M. S., M. D., Ann Arbor, Mich.: Am. Jour. of Syph., Gonorr. & Ven. Diseases, V. 20, 5 (September 1936) pp. 467-481, incl.

PRESENT DAY CONCEPTS OF ENDOCRINOLOGY¹

By PAUL F. DICKENS, Lieutenant Commander, and OMAR J. BROWN, Lieutenant, Medical Corps,
United States Navy

FOREWORD

During the past few years endocrinology has developed into a well-recognized and important clinical specialty. To be sure, it is still in its infancy, so to speak, although the original work in this field was done almost 100 years ago. In spite of the enormous amount of work devoted to this subject in recent years, both in the laboratory and in the clinic, there is still much of the physiology of the hormones—the chemical regulators governing the processes of growth, reproduction, and general metabolism—which is little understood and more that is not known. But already some knowledge is sufficiently precise to be of value to the clinician in diagnosis, prognosis, and therapy.

This article is a report of the lectures given by Lt. Comdr. Dickens to the officers under post-graduate instruction at the United States Naval Medical School during the term 1935-36. In reporting these lectures it is hoped that they will serve as a summary of the present status of this complex but important and growing field of medicine. Further, it is hoped that they will help to clear up some of the vagueness and confusion which has come to surround this subject owing to the multiplicity of new names and terms and apparent contradictions in the results obtained by different investigators using supposedly the same hormone (frequently because of work with impotent or impure mixtures of hormonal substances). Also, perhaps they will serve as an aid in setting a course by which further travel on the poorly charted "sea of the endocrines, strewn as it is with the wrecks of shattered hypotheses" may be made less difficult.

During the delivery of these lectures no general attempt was made to give proper credit to those who, by their studies and reports, have built up the concepts of endocrinology which we hold today. But in

¹ Received for publication May 13, 1936.

the appended list of references for collateral reading are those articles from which the greater portion of this material was abstracted, frequently verbatim when the wording adequately and completely expressed the thought that Dr. Dickens was trying to establish. By this acknowledgment we hope to be absolved of all charges of plagiarism, and further, we wish to state that no claim whatsoever is made for originality, the primary idea being merely to condense the literature for the purpose of instruction.

GENERAL CONSIDERATIONS

The modern concepts of endocrinology, as Dr. Frank so aptly states, have made it necessary to revive the obsolete humoral pathology of the ancients which predicated four essential "humors"—blood, phlegm, black bile, and yellow bile. Before the presence of hormones circulating in the blood was demonstrated the interpretation of many phenomena could be explained only by the humoral hypothesis. Today this hypothesis has been verified, insofar as the blood is concerned, by the demonstration of the circulation of hormones.

For almost a century research workers have been experimenting with the endocrine glands to furnish us with the comparatively meager amount of knowledge which is today available. In 1849 Berthold noted that the transplanting of testes into castrated cocks resulted in a restoration of the secondary male characteristics, an indirect proof of the circulation of an internal secretion of the male gonad. However, this observation attracted but little attention and lay forgotten for almost 50 years. In 1896 Knauer obtained similar results in female animals of the same species by transplanting ovaries. In 1905 Halban, from clinical data and observation was convinced that the placenta was an organ of internal secretion and this has since been proved by experimental work. In 1907 Leo Loeb showed that the corpus luteum produced a hormone, now commonly called "progestin," and from 1912 on, numerous investigators have shown that the extracts from the ovary and the placenta contain a substance, or substances, which cause oestrogenic changes in the uterus of castrated or immature animals. In 1923 the work on these oestrogenic principles was given a tremendous impetus by the development of a simple, rapid, and specific test for the qualitative and quantitative determination of these substances by Allen and Doisy.

Smith in 1925, and Aschheim and Zondek shortly thereafter, announced their discovery that the gonads, both male and female, remained dormant unless activated by the secretion of the anterior lobe of the pituitary gland. That there was such a gonadotropic factor produced by the anterior pituitary gland changed all the previous concepts of endocrinology and as experimental work continues

the hypothesis that the anterior lobe of the pituitary is the "master" gland of the body is apparently being borne out.

The work on the testis hormone has not been as rapid or as spectacular as that of the oestrogenic hormone but slowly and steadily our knowledge has been increasing since 1927 when McGee succeeded in obtaining active lipoidal extracts of the testis. The presence of this testicular hormone can be demonstrated by several methods—the effect on the comb, wattles, and spurs of capons as well as by other tests based on the regeneration of seminal vesicles and prostate function. These same tests when used under controlled laboratory conditions also serve as a means of estimating the quantity of this hormone present.

PHYSIOLOGICAL CONSIDERATIONS

In the early stages of life, the growth of the sex organs takes place probably at the same rate as that of the rest of the body, and specific cyclic changes are not to be observed. But later in life, at times with dramatic suddenness, a change takes place and the whole sexual apparatus becomes activated. The morphological changes which are connected with sexual activity take place only for a limited period of time in the life span of the female. This period of activity is succeeded by a period in which we again have no cyclic changes and the sex organs are involved in the gradual atrophy and senescence of age.

The factors which limit the sexual life cycle and produce such profound morphological changes are not yet definitely understood. It is known that three groups of organs, (a) the pituitary; (b) the ovary (testicle) and (c) the secondary sex organs are reciprocally related, or interdependent, the one on the other. A definite realization of the importance of this coordination and interdependence between the organs named is just as essential to the proper understanding of the control of the sex cycle and sex life as it is to understand, and know, the functions and hormonal activity of each gland or organ.

The well-known periodic morphological changes in the uterus and other secondary sex organs (vagina, fallopian tubes, breasts, etc.) have been shown to be under the control of specific hormones, "oestrin" (theelin) and "progestin", produced by the ovary. The ovarian hormones, secreted at various stages of ovarian activity, act upon the uterine endometrium, the uterine muscle and the other organs (breasts, etc.) to bring about alterations which constitute the different stages of the uterine cycle. Further, it has been demonstrated that the morphological changes which take place in the ovary are in turn subjected to control by specific hormones, "prolan-A" and "prolan-B", secreted by the anterior lobe of the pituitary gland which also regulates, and initiates the hormonal activity of the ovary.

(Some investigators believe prolactin to be a single hormone and do not recognize the two fractions A and B). Thus it is that the anterior lobe of the pituitary gland secretes a hormone, or hormones, which, acting on the ovary, produces two types of effect: First, a change in structure which is characterized by follicular maturation, ovulation, and luteal tissue formation, and second, the initiation of the specific hormone activity of the ovary. From these physiological facts we say that the anterior lobe of the pituitary gland controls the activity of the ovaries, which in turn controls uterine changes and changes in the other secondary sex organs.

But one must understand that additional mechanisms have to be considered. From our present knowledge it seems likely that the pituitary activity itself is not independent of the ovarian hormones or of the changes in the uterus. The amount of the ovarian hormone in the circulation apparently produces an inverse chemotactic call on the pituitary for the liberation of its hormone. Also, during pregnancy a new organ is developed, the placenta, which plays an important part in regulating the quality and quantity of hormones secreted by the various organs in order to maintain gestation, and to initiate parturition.

The functional interrelationships which underlie sexual activities are most important. The stimulus of the anterior lobe of the pituitary gland is not known. However, we know that certain specific hormones are secreted by the anterior lobe of the pituitary gland during the whole period of life, in the immature and in the senile, with certain qualitative deviations during the period of sexual activity. It is further known that ovaries of the immature and the senile are capable of responding, to a degree, to the anterior lobe hormones. Therefore it appears that we must have some quantitative factor involved, and in addition to this there may be some inhibitory substance concerned in determining the normal ovarian activity and for reactivating a hypofunctioning ovary. The pituitary must pass into the circulation a certain quantity of hormones before reproductive activity of the ovaries takes place. Therefore, if we have an inhibitory factor more potent than the stimulus we do not have a harmonious activity.

In addition to all this, there are definitely certain psychical changes associated with the sexual mating. All the recent work on hormones, showing the functional changes induced by specific hormones, has also demonstrated, to some extent, that there is a relation of hormonal response to sexual reflexes. The mating reflexes are subject to a number of external factors; the time, the place, aesthetic sense, health, hunger, and anatomical facts. Thus, when considering the mode of action of hormones in lower animals and human subjects,

it is necessary to determine their relation both to the changes occurring in certain organs and to the reflexes associated with such changes; the sexual, menstrual, and reproductive activity reflexes.

The changes which must be studied may be classified under three headings: (1) Morphological changes not associated with pregnancy, (2) the morphological changes associated with pregnancy, and (3) alterations associated with sexual and reproductive reflexes.

STUDY OF THE PHYSIOLOGICAL ACTION ON LOWER ANIMALS

The sex cycle of the mouse has been chosen for illustration because the mouse, like man, is a spontaneous ovulating animal and has been studied in great detail. In the mouse the female will mate only when in oestrus. These periods occur at definite intervals, usually every 5 or 6 days, and last from 1 to 2 days.

Oestrus is accompanied by certain definite changes in the uterus, vagina, and ovary. The uterus becomes enlarged and is distended with fluid secreted by the endometrium. The changes in the vagina are characteristic and have proved valuable in detecting sex hormones in human blood and urine. During the dioestrus period the vagina is lined with nucleated epithelial cells. During oestrus these cells lose their nucleus and become keratinized and at the height of oestrus only cornified cells are to be found in the vaginal smear. Toward the end of oestrus the vagina is invaded by leucocytes and these polymorphonuclear cells tend to make up the entire smear. By studying vaginal smears it is possible to determine the stage of oestrus. Just preceding oestrus the ovaries show a rapid growth of the graafian follicles which approach the surface in preparation for the extrusion of the ovum. During oestrus a number of the follicles rupture, and the ova, thus set free, pass into the fallopian tubes. If mating takes place and fertilization results, definite changes are observed in the uterus, the vagina, and the ovaries. In the site of the ovulated follicles corpora lutea are formed and these corpora lutea remain active during the whole of pregnancy.

If mating takes place, but fertilization of the ova does not occur, the changes typical of pregnancy nevertheless ensue. The corpora lutea develop and by the action of its specific hormone, progestin, the uterus as well as the vagina show the progestational alterations of pregnancy, except for placenta formation. These last for a few days and then subside. This syndrome is called "pseudo-pregnancy." If no mating takes place oestrus is regularly repeated since the corpora lutea formed become inactive and have no effect on preventing the next regular oestrus period. In pseudopregnancy the corpora lutea continue active for a short period of time and no placenta developing, their activity ceases and oestrus is again reestablished. The important fact to be emphasized is that the regular succession

of oestrus cycles in the sexually mature animal can be physiologically interrupted in only three ways: (1) By pregnancy, (2) pseudopregnancy, and (3) senility.

If we step up to a higher animal, the rabbit, a nonspontaneous ovulating animal, and again study the sex cycle we obtain information of considerable value as applied to man. Unlike the lower rodents, the period of heat in the rabbit is more or less continuous and lasts for a number of months during the year, anoestrus occupying probably only 2 months, October and November. (This statement applies to the domesticated or laboratory rabbit under favorable conditions. In the wild state the oestrus cycle occupies probably at the most, 6 months—from May to October. Here environment must play a part). The rabbit is a peculiar animal in that it will mate at any time, during oestrus and in addition during pregnancy and pseudopregnancy. The alterations in the vaginal epithelium are not sufficiently definite to be of diagnostic value. The immature rabbit's uterus is small, pale, and the endometrium is thin, showing few or no folds and no glandular development. At the onset of sex life (maturity) and when in oestrus, there is a marked growth involving both the uterine muscle and the endometrium. The uterus becomes red and hyperemic and the endometrial glands develop. During anoestrus (October and November) atrophy takes place both in the endometrium and in the muscle while the uterus becomes pale and anemic.

If mating occurs while the rabbit is in oestrus, the endometrium goes through certain definite changes concomitant with corpora lutea activity in the ovaries. These alterations are so definite and so characteristic of the stage of luteal activity that they have diagnostic value in revealing the presence of the luteal hormone in human blood and urine. The endometrial glands show marked development in preparation to secreting nourishment to the embryo until fixation takes place (about the eleventh day). These glands branch in a fairly typical manner giving a fern-like appearance. If the mating has been fertile, placental development takes place after the implantation of the ova. The endometrial changes are continued up to about the twentieth day in all parts of the uterus, those containing the embryos as well as those not containing the embryos.

If mating occurs and no fertility results, or if artificial stimulation of the cervix is resorted to, pseudo-pregnancy ensues and the endometrial changes in preparation for nidation of the ovum take place as before. This preparation for nidation is called the progestational stage. The activity of the hormone, progesterin, reaches its height at about the eighth to ninth day, and if no implantation of the ova takes place, retrogression sets in and is complete at about the eighteenth day.

It will be recalled that the mouse spontaneously ovulates with each oestrus cycle. In the rabbit the condition is different as ovulation is never spontaneous. On the contrary, it follows the performance of a very definite act, mating, or the setting in action of the sex reflex by a stimulus simulating copulation.

Normal mating in the rabbit is, as a rule, followed by follicle maturation, ovulation, and the formation of corpora lutea. These results ensue whether fertilization has occurred or not. We referred to the setting in motion of the sex reflex by acts simulating mating. By this we mean to say that in the rabbit follicle maturation, ovulation, and corpora lutea formation can be brought about by artificially stimulating the vagina and cervix and it is therefore independent of the presence of the male. Furthermore, ovulation may follow merely the presence of the male without penetration of the vagina. If local anesthesia of the vagina is induced and coitus then allowed to take place, the changes in the ovary also occur. Again, the handling of, or the jumping of one female by another will produce the same changes. Therefore, in the rabbit, there must be some central excitatory stimulus to set the process on motion. Hence, in the rabbit, following a nonfertile mating, as in the mouse, a pseudopregnancy takes place with follicle maturation, ovulation, and corpora lutea formation followed by retrogression at the time nidation should normally occur. In the rabbit, immediately after ovulation, bleeding occurs in the graafian follicle and the blood clot becomes organized and transformed into a corpus luteum which, by means of its own specific hormone, exercises, in lower animals, the important function of maintaining pregnancy. The formation of a corpus luteum constitutes the most important morphological change in the ovary. The uterus also goes through a morphological change preparatory to the nidation of the ova. Following nidation another important change takes place in the uterus, namely, the formation of a placenta.

To appreciate fully the cycle of menstruation it is believed that an understanding of the oestrus cycle in the bitch will help. The dog has an exceedingly simple sex cycle in many respects, as it has only one heat period in a sexual season. When the bitch is in anoestrus there is complete sexual quiescence. Following this we have a gradual process taking place, the prooestrus phase. The importance of this phase is that destructive changes take place and bleeding occurs. This is a resemblance to menstruation in the human. Following prooestrus, the oestrus phase occurs. Oestrus begins with the cessation of bleeding and in a few days the animal will mate. Ovulation takes place spontaneously at oestrus regardless of mating (simulating the human). After ovulation, corpus luteum formation takes place and the specific progestational and gestational changes in the uterus

occur. If the ova are fertilized, nidation and placental formation follow. Therefore, it is seen that a series of cyclic changes occur in the ovaries and uterus of animals regardless of spontaneous or mating ovulation. Following this, then, let us see of what these cyclic changes consist before considering the same cycle in the human.

It is important to see what changes occur in the uterus. In studying the physiology of the uterus it is best to regard it as an organ consisting of two essential parts: (1) The endometrium or internal and secretory glandular portion and (2) the muscle or external protective and expulsive portion.

The whole organ, of course, is essentially concerned with the development of the embryo, but the two portions serve very different functions. The endometrium undergoes changes necessary for nidation of the ovum and later on is devoted to nutrition of the developing embryo. The muscle has, during the course of pregnancy, a protective function and ultimately, upon its activity the expulsion of the foetus depends. What initiates this contraction of the muscle at 10 lunar months is not yet known.

The cyclic phenomena in the mouse shows that in oestrus we have swelling of the glands of the endometrium with marked hypertrophy and secretion. The uterus is distended and later in oestrus with the endometrial break-down the fluid escapes. This degeneration of the endometrium is followed by rapid and complete repair and inactivity of the glands. Now if mating occurs and fertilization takes place, no degenerative changes occur and the columnar type of cells persist for 3 or 4 days and the leucocytic infiltration disappears. The endometrium in this phase can furnish nutriment to the ovum, and allows implantation of the fertilized ovum. The fertilized ovum spends its first 3 or 4 days in the fallopian tube and during this time the endometrium possesses a physiological property, namely the power of forming decidual cells. The implantation of the ovum is associated with the development of the placenta and in this development the endometrium takes part by the formation of decidual cells.

If pseudopregnancy takes place the decidual cell formation has responded to a nonspecific stimulus. Loeb, by cutting a block from the endometrium found that a large number of new decidual cells are formed, within a few days, at the site of the incision. These tumor-like masses of decidual cells have been named deciduomata or placentomata. The same tumorlike mass will form if a loop of silk suture is inserted in the endometrium and tied. The irritation is a sufficient stimulus to initiate decidual cell formation. Thus we can see that the pathologist can no longer take uterine scrapings and make a diagnosis of missed abortion or pregnancy, on the finding of decidual cells alone.

PHYSIOLOGICAL ACTION OF HORMONES IN HUMANS

Before undertaking to study the menstrual cycle in the human a short review of the action and function of the female reproductive cycle is in order. The ovaries in which the ova are formed constitute the essential organs of reproduction in the female. Primordial follicles are by some, supposed to be present from birth on. Some of these develop graafian follicles but others never attain maturity, instead they undergo retrogression and atresia. When the young girl attains sexual maturity, the graafian follicles mature, and periodically ova are formed which are extruded and directed to the open end of the fallopian tube. This sexual maturity is accompanied by alterations in the secondary sex organs, the vagina, uterus, and mammary glands, and by the acquisition of secondary female sex characteristics.

At birth, the uterus of the female infant and the breasts of both sexes are larger and better developed than some time later. This certainly suggests the act on and influence of hormone activity derived from the mother as does the occasional presence of "witches milk" which is due to the presence of the lactogenic hormone in the blood of the infant derived from the blood of the mother.

Following birth, retrogression sets in and the girl attains and retains a neuter state as regards the secondary sex characters until puberty. At this time a marked somatic and psychic change is established. The attainment of puberty may be divided into (*a*) the gradual development of secondary reproductive organs and the acquisition of the female sex characteristics which are the formation of the female type of pelvis, characteristic hair pattern, characteristic fat distribution, growth of the breasts, nipple erection and in addition heterosexual inclinations which are introduced by the appearance of shyness and modesty, and (*b*) the abrupt onset of menstruation and ovulation. Libido is not necessarily awakened at puberty and its excitation usually depends upon an external stimulus—suggestive books, pictures, onanism, love, or seduction. The libido in the male is spontaneously excited at puberty.

Ovulation and menstruation continue during the reproductive period with the exception of its interruption by pregnancy and lactation. Following the reproductive period there gradually appears a cessation of ovulation and menstruation—the menopause.

The female may therefore be said to have two superimposed cycles (1) a life cycle consisting of prepubescence sexual maturity, and post climateric inactivity and (2) a superimposed monthly reproductive cycle which involves ovulation, corpus luteum formation and changes in the uterine mucosa leading to endometrial sloughing and bleeding. The interrelation of the ovaries with uterine changes, their correlation with the sexual activities, and above all the controlling mechanisms,

are now gradually being unfolded by the study of the action of the hormones on lower animals.

MENSTRUATION IN THE HUMAN

It has been said, and truly so, that the human uterus is the most optimistic organ known to mankind. Periodically and repeatedly through the action of hormones the endometrium is built up in anticipation of the reception of a fertilized ovum. Fertilization not occurring, the uterus sheds this endometrial structure accompanied by a flow of blood in a phenomena known as menstruation. This optimistic attitude of building in anticipation, and tearing down to rebuild again, in cyclic waves on a average of every 28 days, is continued throughout the sexual life cycle of a normal woman.

The postmenstrual phase.—During the 8 to 10 days following menstruation, assuming a 3- to 5-day period, the primordial follicles and ova mature and move toward the surface of the ovary. The endometrium at the end of menstruation consists of a narrow layer of mucosa with a single glandular remnant. During the postmenstrual phase the endometrium gradually increases in thickness, the blood and lymph spaces become filled and the glands increase in size, tortuosity and branching. This is the copulative phase in humans and the oestrus phase in animals.

Premenstrual and ovulation phase.—This phase, ushered in by the rupture of the graafian follicle with the liberation of its ovum, occurs about the thirteenth day after the first day of the previous menstruation. The vaginal smear at this time shows increased leucocytes with cornification of the cells and corresponds to the metoestrus stage in animals. After liberation from the follicle the ovum passes down the fallopian tube and at the site of the ruptured follicle a true corpus luteum begins to develop which gradually reaches maturity in about 7 to 10 days. Because of the corpus luteum formation at this time, some like to refer to this period of the monthly cycle as the corpus luteum phase. During the phase of corpus luteum formation the endometrium becomes greatly turgescient, hyperplastic, and the glands more tortuous. Mucous goblet cells are common and their dilated lumina are filled with secretion owing to the constricted necks. Decidual cell formation takes place in the stroma and the endometrium is thus prepared for the implantation of the fertilized ovum. If pregnancy does not take place, a short stage of corpus luteum maturation, pseudopregnancy, occurs in the latter part of the premenstrual phase. Following this the corpus luteum retrogresses and coincidentally with the retrogression of the corpus luteum, the mucous secretions increase, the endometrium breaks down and bleeding, the menstrual phase, occurs. There is the tendency on the part of some to consider the entire period during which there is no

bleeding as the premenstrual stage but in order to understand hormonal activity it should be divided as given here.

The menstrual phase.—The menstrual flow begins as a seromucous secretion with a pungent odor, containing many leucocytes and lipoid material at first tinged with blood, later becoming hemorrhagic. After continuing for 3 to 5 days, the flow subsides. The total quantity of fluid varies from 20 to 200 grams.

While it is usually possible to appraise the ovarian function by the regularity and duration of menstruation, the presence of menstruation is not necessarily assurance of ovulation—or that an unfertilized ovum has passed; and absence of menstruation does not necessarily preclude the ability of the female to ovulate. These facts are important in the interpretation of hormonal activity and the therapeutics of dysmenorrhea and amenorrhea. A number of signs occur before menstruation. The tubes, vagina, and vulva engorge, the vaginal secretions increase, and the mammary glands become enlarged, full and tense.

The chances of the ovum becoming fertilized hinges on the viability of the ovum and the possibility of its meeting a viable spermatozoa. The viability of an unfertilized ovum probably can be measured in hours. The accepted maximum period of its survival is 48 to 72 hours, and that of the spermatozoa 72 hours. Fitting these facts into the correlated changes of ovulation we find that the greatest chance of fertilizing an ovum is from 9 to 18 days after the first day of the previous menstruation. It is stated that the greatest chance for fertilization is on the thirteenth day from the beginning of the previous menstruation, in a woman with a 28-day cycle. On the other hand, if ovulation takes place at this time, and the greatest length of viability is 72 hours, it follows that, in a woman with a 28-day cycle, the chance of fertilization taking place after the eighteenth to twentieth day following the beginning of the previous menstruation is practically nil. This is the so-called "safe" or "sterile period".

Experimental work suggests that sex maturation, as well as the periodic changes in the ovary and secondary sex organs during the menstrual cycle and pregnancy, are not under nerve control but occur through the harmonious interaction of hormones secreted by the anterior lobe of the pituitary gland and by the ovaries. Certain facts in regard to these hormones seem clear, but their actual number, their identity or nonidentity or separate factors and especially their interrelationship or definite biological effects, are not as yet fully understood.

Menopause (change of life; climacteric).—This is defined as that period of life when menstruation ceases and when the woman ceases to ovulate. The signs and symptoms occur gradually and in the great majority of cases appear between the ages of 41 and 50, the

average age being 47 years. This is the natural menopause. Artificial menopause may be induced at any age after puberty by the surgical procedure of castration, by radiation of the ovaries and also by the use of radium in the lower abdomen. Artificial menopause may also be induced by radiation of the pituitary gland. The menopause is not due solely to hypofunction of ovarian activity, but there is also a loss of pituitary control. The menopause, then, may be said to be a pluriglandular dysfunction with changes in the ovaries, thyroid, adrenals, and pituitary.

Taking these up one by one, we have first hypoovarianism, with progressive fibrosis, atrophy, and follicular cytolysis. The vasomotor symptoms and nervous manifestations are said to be due to the loss of the ovarian hormone, oestrin. Early in the menopausal stage the few remaining follicles may mature but are prevented from rupturing by the fibrotic tissue surrounding the follicle, thus producing follicular cytolysis. As a result of the continuing fibrosis the ovary finally becomes atrophic.

Hypothyroidism, with its concomitant symptoms is a common finding. These may be mild or severe. The most common ones are menopausal obesity and mild stages of myxoedema. In a few instances hyperthyroidism, or dysthyroidism occurs.

The medulla and the cortex of the adrenals are involved in a hyperfunction. Hyperadrenalinemia, that condition characterized by an excess production of adrenin, gives the symptomatology produced by an injection of the medullary extract adrenalin. These symptoms are transient hypertension, vasomotor disturbances, hyperglycemia, and glycosuria. From the hyperfunction of the cortex we have hyperadrenia characterized by masculine distribution of hair, virilism, and voice changes.

Owing to the coordinated relationship existing between the production of ovarian hormones and the sex hormone of the anterior lobe of the pituitary gland, there is an increase in the sex hormone at this time which can be demonstrated in the blood. This may be due to a temporary hypersecretion of this hormone or its failure to be utilized. However, this is soon followed by a hyposecretion with a resultant gradual suppression of sex desire. During this temporary hypersecretion these women may be looked upon by their companions as being oversexed.

Summary of symptoms.—The natural menopause is ushered in insidiously by the gradual decrease in the amount of blood lost at each cycle and a progressive lengthening of the cycle. A few cases may cease menstruating suddenly. The vasomotor symptoms, hot and cold flashes, sweating, faintness, epistaxis (commonly called vicarious menstruation) and similar symptoms are usually followed by the nervous manifestations. These are emotional instability,

easy fatigability, headache (which often yields to thyroid medication), excitability, and irritability. In a minority psychic symptoms, phobias, involution melancholia, and even suicidal tendencies may develop. These psychic symptoms are more prone to occur in artificially produced menopause and the menopause coming on early in life.

Usually the more common signs of the menopause are taken for granted, but the careful physician should take note of the appearance of such symptoms as loss of libido, sterility, frigidity, and gain in weight accompanied by various digestive disturbances such as nervous dyspepsia, flatulence, marked gas formation, vomiting, nausea, and pain or burning in the esophagus or pharynx. Finally the senescence of age takes its toll with the progressive atrophy of the sexual organs.

THE ANTERIOR PITUITARY GLAND

One cannot but be impressed with the reciprocal relationship existing between the hormones produced by the various glands of internal secretion which insure normal physical and mental development. In normal persons a hormonal equilibrium exists. In disease there is either a qualitative or quantitative alteration in the equilibrium producing a dysfunction which often involves more than one gland. As the science of endocrinology develops we become more and more impressed with the fact that seemingly the secrets of life are locked up in the little chemical messengers, called hormones, elaborated by the ductless glands. The members of this chemical messenger society are: (1) The pituitary, (2) the thyroid, (3) the parathyroids, (4) the adrenals, (5) the ovaries (testicles), (6) the pancreas, and (7) as a member often absent, the placenta. The mammary glands, the liver, the pineal, and the thymus may be classed as associate members.

It seems to be definitely established that the pituitary is the "master gland" of the body. There appear to be but few body functions that are not influenced either directly or indirectly by its anterior lobe. The close functional relationship existing between the anterior lobe and the ovary has led Zondek to refer to the pituitary as the "motor" to the ovaries. Collip holds a similar view. The facts leading to this inference are that pituitary transplants lead to follicle growth and precocious sexual development while ablation of the anterior lobe of the pituitary causes failure of the follicles to develop, atresia of follicles which have ruptured, atrophy of the uterus and vagina, and nondevelopment of the menstrual cycle.

Including the action on the ovary there are 16 activities which have been credited to the anterior lobe of the pituitary gland of which 6 seem to be proved. The 16 accredited activities are:

- (1) Stimulation of growth—the growth producing hormone.
- (2) Stimulation of ovarian function (to produce follicle ripening and corpus luteum formation as well as stimulating seminiferous gland activity)—the gonadotropic hormone—prolan-A.
- (3) Stimulation of luteal cell formation—prolan-B.
- (4) Stimulation of sexual maturity.
- (5) Stimulation of metabolism.
- (6) Stimulation of the thyroid gland—the thyrotropic hormone.
- (7) Lowering of basal metabolism.
- (8) Increase of water intake and excretion.
- (9) Excitation of lactation—the lactogenic hormone.
- (10) Lowering of the non-protein-nitrogen of the blood.
- (11) Initiating the bleeding of menstruation.
- (12) Modifying carbohydrate metabolism—the diabetogenic hormone.
- (13) Influence on the adrenal gland—the adrenotropic hormone.
- (14) Influence on the islets of Langerhans—the pancreotropic hormone.
- (15) Regulation of fat metabolism.
- (16) Melanophoric hormone of animals—pigmentation in pregnancy; adaptation of the pupil to light.

Available evidence indicates that six substances can be separated from the anterior lobe of the pituitary gland, each with a separate function and which may be tentatively classed as a hormone. They are:

- (1) The growth hormone.
- (2) The gonadotropic hormone—prolan, containing both factors, A and B.
- (3) The thyrotropic hormone.
- (4) The adrenotropic hormone.
- (5) The lactogenic hormone.
- (6) The pancreotropic hormone and/or diabetogenic factor.

With so many body functions apparently dependent upon the activity of the pituitary gland it is not difficult to see why it has been designated as the “general headquarters” of the endocrine system.

THE GONADOTROPIC HORMONE OF THE ANTERIOR LOBE OF THE PITUITARY

In 1910 Cushing and his coworkers demonstrated that hypophysectomy caused an atrophy of the reproductive system. The discovery in 1926 that the anterior pituitary gland secreted a substance essential to the function of the gonads has been followed by many investigations which have greatly extended the knowledge of the pituitary-gonadal relationship. In 1927 restoration of gonadal function after hypophysectomy with hypophyseal implants and induction

of precocious sexual maturity with the same treatment conclusively demonstrated that the anterior lobe maintained and controlled the action of the ovaries and testes and through them influenced the other reproductive organs.

The anterior pituitary probably secretes two definite gonadotropic hormones which Aschheim and Zondek have named prolan. One of these causes follicular stimulation and is designated as prolan-A. The other, which induces luteinization, is termed prolan-B. The follicular hormone, prolan-A, may be said to be gametogenic in that it primarily stimulates the germ-cell line; the male germ cell as well as the ova and granulosa cells. Prolan-B, the luteinizing fraction, acts on the theca cells of the ovaries and the interstitial cells of the testes causing them to secrete their hormones; the ovaries, oestrin, and progesterin, the testes, androsten. It will be seen, therefore, that the anterior lobe of the pituitary gland secretes a hormone which produces maturation of the follicle and also secretes a hormone which produces luteinization.

The presence of two distinct substances in prolan is doubted by some since they have not been definitely isolated and identified. This has led to the controversy as to the unity or duality of prolan—a problem which is of the greatest importance in the study of the physiology of the gonadotropic hormones of this gland. However, a clearer concept of the action of prolan is obtained if we consider that it is made up of two distinct and separate principles. When the term prolan alone is used it will be to signify the sexlike hormone of the anterior pituitary gland containing fractions A and B jointly.

Trade names for some of the prolan preparations now commercially available and which contain mainly prolan-B are:

Antuitrin.
Follutein.
Antophysin.

These preparations are made from the urine of pregnant women.

It is known that the gonadotropic principle present in the urine and blood of pregnant women is definitely different from that present after the ovaries have been removed or after the menopause has definitely taken place. Extracts from pregnancy urine will not cause follicle growth in the absence of the pituitary gland, but it does produce luteinization if the ovary has previously been stimulated by the follicle forming hormone—prolan-A. Following removal of the ovaries or the complete establishment of the menopause, hormonal extracts from the urine of these women causes marked follicular growth; in fact, it appears to give almost the pure follicular stimulating action of prolan-A. Therefore, since this action is practically identical with the purest follicle stimulating hormone it seems justifiable to assume that this principle is of pituitary origin. However, solution of the

problem of whether or not pregnancy urine contains a gonadotropic hormone which is secreted by the anterior lobe of the pituitary gland must await fractionation of this principle and comparison of the ~~solid~~ products with a pure hormone made from the anterior lobe of the pituitary gland.

From the evidence at hand, it seems that the anterior lobe of the pituitary gland does produce a hormone which is follicle stimulating or gametogenic. As stated before this hormone is found in the urine of castrates. The status of the luteinizing gonadotropic hormone, prolan-B, is not as definite as that of the follicle stimulating hormone. The urine of pregnant women contains this luteinizing principle. The present indications are, then, that in the therapy of hypogonadism due to anterior pituitary deficiency the administration of a mixture of these two factors will be required to induce normal gonadal function.

At the present time the extracts of gonadotropic hormones are far from being pure chemical products. They are not very far removed from soup-like substances and the inability to get pure hormone extracts is one of the reasons for the various physiological functions assigned to these hormones.

The most that can be said at the present time is that the anterior lobe of the pituitary gland does secrete a ~~gametogenic~~-germ cell line stimulator—a follicle ripening hormone commonly known as prolan-A. Also, in all probability it secretes a second hormone which produces luteinization of the ovary and is known as prolan-B.

THE OVARY

Previously we discussed the relationship of the anterior pituitary gland to the various endocrine glands and especially its effect on the ovary—follicular maturation and ovulation as well as the formation of luteal tissue and the stimulation of the ovary to produce its own internal secretion.

Before puberty the ovary is a small, undeveloped organ and the various morphological and secretory changes which characterize its activity during maturity are not observed. The onset of sexual maturity is heralded by a sequence of events which are repeated throughout the period of sexual life.

Broadly speaking, it may be said that follicular maturation occurs in waves during the whole period of sexual activity, or sexual life of the individual and with a rhythm fundamentally related to the ovulation cycle. It has usually been accepted that the primordial follicles (or immature ova) were all formed before birth and remained quiescent until maturity when they were supposed to ripen at definite intervals. But this theory has recently been challenged, in that one school of thought now presupposes that a number of germinal epi-

thelial cells may enlarge and develop into sex cells while the remaining epithelial cells form a group known as the follicular cells. According to this theory, at each wave of maturation a large number of follicles undergo retrogression. The formation of a corpus luteum takes place in the Graafian follicle after ovulation. Therefore, in the investigation of the secretory activity of the ovary it is necessary to study two chief structural parts: (1) the luteal tissue (corpus luteum) and (2) the remainder of the ovarian tissue including the Graafian follicle, interstitial tissue, etc.

THE OESTROGENIC PRINCIPLE

In evaluating the present-day literature it is essential that the difference in the meaning of oestrus and oestrogenic principles be borne in mind. By the term oestrus it is intended to designate the restricted period of mating in the female animal. The outstanding criteria of oestrus is the female animal's intense "sex-urge" or "sex-drive." Since the sexual urge in woman is not restricted to such a brief, intense period, the term oestrus is not used in connection with the menstrual cycle except where especially designated. Recent work with the ovarian hormones has emphasized another definite aspect of these hormones at oestrus; namely, the rapid growth of the accessory genital organs. This rapid growth may be induced experimentally by the ovarian oestrogenic hormone. This hormone, therefore, is primarily a sex-growth hormone in that its action affects the female genital tract, the mammary glands and secondary sex characteristics. The term oestrogenic substance is now used to include any substance which will induce this growth and also those substances which activate the resting ovaries in animals out of the breeding season. Also, they have been extended to include those substances which will produce oestrus in immature animals.

The follicular cells of the Graafian follicles, or as now appears more probable, other portions of the ovarian tissue, produce a sex hormone variously known as "oestrin", "theelin", "progynon", "folliculin", "oestrogen", and "menoformon." But it must be emphasized that the ovary is not the only site of origin of this hormone and that the production of oestrus is not its only function. Theelin or oestrin, to use the more common names, has been isolated not only from the liquor folliculi but also from pregnancy urine, from the foetal end of the umbilical cord, from the placenta and from the amniotic fluid. During pregnancy the placenta produces an enormous quantity of this hormone, the amount increasing as the placenta grows in the process of gestation.

Our knowledge of oestrin has been obtained chiefly by three methods: (1) The removal and implantation of ovarian tissue, (2) the injection of oestrogenic preparations, and (3) the injection of

substances which stimulate the ovary to secrete its own oestrin. It has been known for a long time that castration interfered with sexual activity. It was found that this operation was followed by a cessation of all the morphological and physiological changes of oestrus with resulting atrophy of the uterus, vagina, and other secondary sex organs. It has recently been demonstrated that homotransplants, if the transplants took, could restore all the phenomena of oestrus. It was immaterial in what part of the body the grafts were planted. From these experiments it is reasonable to deduce that the ovary did not exert its action through the nervous system but that its action was due to a secretion carried through the circulation, i. e., that the organ served as gland of internal secretion.

The results of castration in monkeys show two types of effects; first, an immediate effect which follows in a few days after the operation and second, a permanent effect characterized by a permanent interference with sexual activity. The immediate effect is due to the removal of the ovarian hormone influence which is sufficient to bring about degenerative changes in the endometrium and insofar as bleeding is concerned resembles menstruation. This is independent of any luteal secretion. This, then, is similar to the withdrawal of oestrin treatment or the rapid fall of oestrin in the blood of the human which is followed by degeneration and menstruation. The permanent effect is a cessation of menstruation with an accompanying decrease in the size of the uterus and atrophy of the endometrium.

By the use of laboratory tests for oestrus (vaginal smears) it has been possible to prove the oestrogenic action of oestrin. Ovarian extracts and follicular fluids when injected into ovariectomized animals were found to elicit the full effect of oestrus. Oestrin or theelin, therefore, is a hormone, which, when injected into an ovariectomized animal (mouse) produces oestrus with the characteristic vaginal smear changes and in addition calls forth in animals the mating reflex. From the foregoing evidence it may be described as a substance produced by the ovary and responsible for the production of oestrus.

Applying this to the clinical studies it has been found that the injection of oestrogenic substances produces proliferative changes in the uterus characterized by an increase in size and proliferation of the endometrium and upon cessation of its administration uterine degeneration and bleeding.

Oestrin exerts its effects not only on the fallopian tubes and uterus but also on the accessory genital organs and the secondary sex characteristics as well. These changes are: (1) An increased growth of the uterus and fallopian tubes, (2) changes in the epithelial lining of the

uterus and the vagina, (3) morphological and functional changes in the glands of the endometrium and an increase in the vascularity of these structures, (4) inhibition of the action of oxytocin on the uterine muscle, and (5) stimulation of the initial growth of the ducts of the mammary gland as well as the growth of the epithelium covering the nipples. Secondary sex characteristics in the female which depend upon the oestrogenic substances are varied. For example, the reddening of the sexual skin in the monkey, plumage changes in birds and the introduction of oestrus itself are all manifestations of the activity of this hormone. Furthermore, the abrupt diminution of oestrin secretion and its decrease in the blood stream may account for the bleeding and uterine mucosal changes during menstruation. Clinically it is important to note also, that nervous tissue reactions vary with different levels of the oestrogenic substance in the blood. With the increase of the oestrogenic substance in the blood there can be demonstrated an increased activity of the reflexes and reports are increasing that the psychic state of an individual may be influenced by the blood level of oestrin.

As has been pointed out the gonadotropic hormone of the pituitary starts the production of the ovarian hormone and at the same time initiates the maturation of the ovarian follicles. These two effects may or may not be closely related. However, as the oestrin ~~content~~ of the blood increases it tends to inhibit the secretion of the pituitary gonadotropic hormone, thus accounting for its decrease in the blood as oestrus or menstruation occurs.

During dioestrus oestrin is used up, or excreted (at least it is decreased), and when it reaches a certain low level the gonadotropic hormone of the anterior pituitary again steps in and activates the ovary to repeat the cycle. Thus, as recent investigations have brought forward, or rather tended to suggest, the cyclic changes are definitely due to an interplay between the anterior pituitary gonadotropic hormone and the ovarian sex hormone. This is the best working hypothesis that has been put forward up to the present time and is based on Corner's "Push and Pull" theory of the alternation of the activity of the two glands.

Oestrin is excreted in the urine beginning at puberty and continues until a short time after the onset of the menopause. During the menopause, oestrin excretion undergoes a definite change and during the initial stages of this period there is an actual increase in the elimination of the hormone in the urine which may last several weeks or even months. This initial stage is marked by hypertrophy of the uterus but after its termination the uterus undergoes atrophic change and oestrin is no longer present in any large quantity for the remainder of life. During the period of sexual activity the amount

of oestrin excreted varies with the different phases of the sex cycle. Oestrin is also excreted in the feces.

The relation of oestrin to menstruation.—Oestrin increases progressively in the blood during the post and premenstrual period and when present in sufficient concentration causes the several changes in the accessory genital organs to take place which have been enumerated before. The curve of the oestrogenic hormone during the menstrual cycle is in the form of two inclined planes. The first or smaller plane reaches its height from the tenth to seventeenth day after the first day of the previous menstruation and corresponds to the time of the ovulation and beginning corpus luteum formation. At this time it breaks rather sharply upward and then continues along in a gradual ascent, the second plane, until about the twenty-first to twenty-fourth day of the cycle which corresponds with the height of the corpus luteum formation. Immediately after this peak, provided pregnancy has not taken place, there is a sharp drop in the oestrin content, menstruation ensues and retrogression of the corpus luteum sets in. It is at this time that the anterior pituitary gland, no longer inhibited by oestrin, starts the production of its gonadotropic hormone which in turn stimulates the ovary to repeat the cycle.

It was formerly supposed that when fertilization failed to occur the destructive break-down followed by sloughing and hemorrhage was due to the corpus luteum hormone, for without the endometrial proliferation due to this hormone no break-down would be possible. This theory was shattered by the demonstration that menstruation frequently occurs without ovulation and the formation of a corpus luteum and that castration in the woman causes uterine bleeding. We must therefore, conclude that while the formation of a corpus luteum fits into the menstrual cycle in a suggestive manner the corpus luteum hormone cannot be responsible for the bleeding and is not necessary for the periodicity of menstruation.

The relation of oestrin to pregnancy.—It has been definitely demonstrated that during the first weeks of pregnancy the oestrin content of the blood and its excretion in the urine is comparatively small, but after the eighth week the blood oestrin content increases and there is a rapid increase in the amount excreted in the urine—up to several thousand rat units per day. This rise in the blood and the rate of excretion continues until the end of pregnancy when there may be as many as 20,000 rat units per liter of urine excreted. After parturition the excretion of the oestrin falls rapidly until it reaches its normal level, usually about the end of the first week of the puerperium. It has been suggested that this large concentration of the hormone is necessary in order to maintain the uterine muscle in a tonic state. It is possible that the excretion during the puerperium may be a factor

responsible for the variations in the rate of the involution of the uterus and the differences observed in lactation under clinical conditions.

The increase in the oestrin content of the blood and urine of pregnancy beginning about the eighth week corresponds to the time at which the placenta assumes its role as a functioning organ. This has lead to the assumption that perhaps these oestrogenic substances are not totally secreted by the ovary through the action of the anterior pituitary gland, but are produced by the placenta which takes on the role of a temporary endocrine gland. That this is more than possible is indicated by the fact that during pregnancy in women, mares, and guinea pigs the ovaries may be removed in early pregnancy (after the second month) without interrupting the pregnancy or diminishing the hormone secretion. The placenta will be taken up later.

THE CORPUS LUTEUM HORMONES

As has been said before, the corpus luteum is formed in the ruptured Graafian follicle. It produces a hormone variously called "luteal hormone", "lutein hormone", "progesterin", and "corporin." The action of this hormone has been variously described as complementary, antagonistic, or competitive to oestrin. Its action is closely associated with that of oestrin, the effect observed depending upon which is in the ascendancy.

Definite proof that the corpus luteum contained a specific substance was adduced by Allen in 1929, when he injected a corpus luteum extract into castrated rabbits and obtained a proliferation of the endometrium similar to that observed during pregnancy. It was also demonstrated that ovariectomy, early in pregnancy of the rabbit, resulted in an interruption of gestation. However the pregnancy could be made to continue by the injection of a potent luteum extract. Allen gave the name of "progesterin" to this luteal hormone and it is now known that the progestational proliferation of the endometrium is due to the action of this hormone. Therefore the ovary may be said to produce the oestrogenic and the corpus luteum hormone, but it must be definitely pointed out and understood, that these hormones act in harmony and that the corpus luteum hormone is unable to exert its activity in the uterus without the presence of oestrin. This is most important as it has a direct bearing on the clinical manifestations of ovarian functions—hypoactivity or hyperactivity. It has been demonstrated that progesterin fails to produce endometrial changes in the uterus unless that organ has been activated previously by oestrin.

Some believe also that the corpus luteum produces a secondary hormone which, in conjunction with oestrin, inhibits the action of oxytocin on the uterine muscle. This hormone has been named

"desensin". Contrary to the view expressed here in regard to the specific hormone "desensin" is the fact that the ovaries can be removed after the second month of pregnancy and the pregnancy continue to term. It appears that it is only in the early stages of pregnancy that the uterine muscle is inhibited to the action of oxytocin by the action of desensin if there is such a hormone. It has been proven that the placenta does not secrete this hormone.

The corpus luteum hormone probably prevents ovulation during pregnancy. Another action which is attributed to the corpus luteum is the production of a specific hormone called "relaxin" which has for its function the relaxation of the pelvic ligaments. However, many authors believe that this relaxation of the pelvic ligaments is an action of oestrin and not of a specific hormone.

It is now believed that the endometrical changes during the menstrual cycle are initiated by oestrin and are completed by the activity of the corpus luteum hormone. That is to say, the progestational hormone is capable of acting only on an endometrium that has been subjected to the action of oestrin. The same holds true of the inhibitory luteal hormone, "desensin", as it is unable to inhibit the muscular contraction of the uterus unless it has previously been treated with oestrin. Moreover, it has definitely been demonstrated that the amount of oestrin necessary to sensitize the uterine muscle to "desensin" is much greater than is necessary to allow for the action of progestin. In other words, the presence of a moderate amount of oestrin in the blood will activate the uterus to allow progestin to produce progestational changes in the endometrium while it takes a much larger quantity of oestrin in the blood to prepare the uterine muscle to respond to the inhibitory action of desensin, assuming that such a hormone is present.

By bringing about proliferation of the endometrium due to the action of the hormone progestin and quiescence of the uterine muscle by the action of desensin, coupled with the harmonious action of oestrin, these luteal hormones create a condition similar to that observed in the early stages of pregnancy. The changes described are, in all probability, preparatory for implantation of the fertilized ovum and gestation. If fertilization occurs, the nidation of the ovum follows and this is accompanied by the formation of decidual tissue. The favorable condition produced for the nidation of the fertilized ovum and the formation of decidual tissue is due to the activity of the corpus luteum and is dependent upon the luteal secretion. If no fertilized ovum is implanted, the corpus luteum involutes and the edifice of the endometrium built by progestin degenerates and menstruation follows. It would seem from this, then, that so long as the corpus luteum is present menstruation cannot take place.

As stated earlier, any trauma of the endometrium results in the formation of decidual tissue at the site of injury. The reaction, charac-

terized by the formation of decidual cells, can only occur during the normal activity of the corpus luteum. This formation of a placenta is specific for uterine tissue and is not found in any other tissue or organ of the human body. On the other hand, it can be formed in transplanted uterine tissue. That this ability of the uterine endometrium to form decidual tissue is definitely due to corpus luteum has been demonstrated by injecting into ovariectomized animals corpus luteum and then traumatizing the endometrium with the resulting formation of decidual cells (1934). This effect, however, can only be produced in a uterus which has previously been treated with oestrin. In this respect it has again been demonstrated that the corpus luteum hormones exert their action only in conjunction with the necessary oestrin action. Thus, it is definitely shown that under requisite conditions of oestrin action, the corpus luteum controls the embedding of the fertilized ovum and the early stages of the formation of the placenta by the activation of the decidual cell formation in the endometrium.

By recent work the corpus luteum has been shown to have no effect on the development of the mammary glands. The preparation of the mammary glands for lactation is apparently due to the specific action of the oestrogenic factor—oestrin.

To recapitulate: Possibly the only effects of progesterin are (1) the production of proliferation of the endometrium with decidual cell formation after that structure has been sensitized by oestrin, (2) the sensitization of the endometrium for the implantation of a fertilized ovum, (3) the inhibition of ovulation and to some degree bleeding, and (4) in conjunction with oestrin it probably plays some role in the prevention of the action of oxytocin, a hormone from the posterior lobe of the pituitary gland, on the uterine muscle. Roles assigned to this hormone by recent work, but as yet unproved, are: (1) Stimulation of the production of a hormone known as relaxin which causes relaxation of the pelvic ligaments in pregnancy, and (2) the production of the hormone desensin. These actions are unproved and seemingly do not hold true because in the pregnancy of humans after the second month the ovaries with their corpus luteum may be removed without interfering with the pregnancy. The relaxing of the ligaments and the desensitization of the uterine muscle to the action of oxytocin seem to be a correlated, but as yet only inferred, interplay of oestrin and placental hormones.

THE PLACENTA

Evidence is accumulating that in pregnancy the placenta acts as a new temporary endocrine gland, extensive studies having shown that at least four substances can be extracted from it. They are: (1) theelin or oestrin (a ketohydroxy-esterin identical with the follicular

interstitial cell hormone of the ovary), (2) theelol (a product of theelin), and (3) emmenin (a compound of theelol and some unknown hormone), and (4) anterior-pituitary-like sex hormone (a hormone substance variously called antuitrin-S, follutein, or antophysin, and which contains more prolan-B than prolan-A and is assumed to be the reason for the maintenance of the corpus luteum during pregnancy).

Since the ovary contains only a very small amount of the oestrogenic hormone while the placenta and pregnancy blood and pregnancy urine are rich in this substance, it has generally been accepted by most workers that the oestrogenic factor secreted during pregnancy is of placental origin. It has been definitely proved that the oestrogenic substance in the urine occurs in an organic combination, as yet unknown.

It is assumed by some workers that theelin (oestrin), theelol and emmenin are one and the same product in different stages of their utilization, theelin being the primary hormone. The latter two products, theelol and emmenin, are oestrogenic hormonal substances which are therapeutically effective when administered by mouth and whose active principle are alcohol-soluble but ether-insoluble. This property of oral efficiency removes them from the class of primary hormones, such as insulin, adrenalin, theelin, etc., which have no therapeutic effect when administered by mouth.

There is a distinct difference in the gonadotropic hormone of the anterior pituitary gland and that which is obtained from pregnancy urine or from the placenta. The anterior pituitary lobe gonadotropic hormone produces follicle ripening and luteal tissue formation while the placental and pregnancy urine extracts will produce neither follicle maturation nor—in the absence of the pituitary gland—corpus luteum formation. The anterior pituitary lobe gonadotropic hormone must therefore contain prolan-A and -B while the anterior-pituitary-like sex factor from the placenta must contain a much larger quantity of -B or -B alone. It is this anterior-pituitary-like sex hormone found in pregnancy urine which is responsible for the reaction in the Aschheim-Zondek and Friedman pregnancy tests. The pregnancy test, then, is dependent upon the action of prolan-B on an ovary which has already been stimulated by the follicle maturing fraction of prolap, prolan-A, from the anterior lobe of the pituitary gland.

VITAMIN E

In passing, it is proper that we mention another essential factor to the life of the placenta and thus of the embryo. This is vitamin E. Vitamin E is essential for the development of a normal placenta and to the continuation of pregnancy, but apparently is not essential to the early stages of reproduction—that is, ovulation and fertilization.

If the mother's diet is deficient in vitamin E the placenta does not develop but dies and undergoes dissolution.

ECTOPIC PREGNANCY

From what has been said of the physiology of the endometrium and the oestrogenic hormones in the decidual cell formation of the maternal placenta and in the nidation of an ovum, it follows that it is necessary that endometrial tissue be present extrauterinly before an extrauterine pregnancy can take place. Endometrial tissue may be transplanted into the abdominal cavity or fallopian tube by a backward reflux during menstruation. If this occurs and the implant takes, progestational changes follow and the fertilized ovum becomes embedded in this tissue. This is an accepted explanation of ectopic pregnancy.

LACTOGENIC HORMONE

There is no evidence available up to this time that the development of the mammary tissue is augmented to any degree by the anterior pituitary lactogenic hormone. It seems that mammary growth is the result of stimulation by the oestrogenic hormone, oestrin. Furthermore, during the growth of the mammary gland produced by the oestrogenic hormone, the lactogenic action is inhibited. However, the complete mechanism by which the lactogenic hormone from the anterior pituitary—"prolactin" or "galactin"—is released, the reason for its lack of action during pregnancy, the role of the uterine factor, the role of suckling or emptying of the milk ducts and other topics in lactation are, as yet, not definitely understood.

Prolactin seemingly has been proved to act only on fully prepared mammary tissue and its action is solely to initiate and excite milk secretion.

THE FOETUS

Recently many articles have appeared in which it was indicated that there was a marked possibility that the presence of the foetus itself was necessary for the maintainance of the complete morphological changes of gestation, and assigned hormonal activity to the foetus. As yet no hormone has been identified nor has it definitely been proved that the foetus produces, or is instrumental in the production of, hormonal activity.

THE CARCINOGENIC HORMONE

It is interesting to note that recent reports show that certain specific carcinomata contain theelin in large quantities and have definite oestrogenic activity. Since the oestrogenic material contains primarily a growth involving substance, and carcinoma is pri-

marily a new growth, the possibility, suggested by analogy, of theelin producing carcinomata is interesting. The fact that certain types of tumors are associated with disturbances of the available supply of oestrogenic substances, clinically evidenced for example in the precocious development in young girls and the reestablishment of menses in the woman past the menopause, seems to bear this out to some degree. Granulosa cell tumors secrete large quantities of the oestrogenic substances and have been found to be responsible for disturbances in sexual activity. Uterine fibroids and hypertrophied endometrium have been found associated consistently with cystic ovaries.

(To be continued)

ACTIVE IMMUNIZATION AGAINST TETANUS WITH TETANUS TOXOID

By W. W. HALL, Lieutenant Commander, Medical Corps, United States Navy ¹

In 1934, 140 volunteers were secured who subjected themselves to the production of active immunity against tetanus by the use of a new tetanus toxoid produced by the Lederle Laboratories, which furnished the material and performed the titrations for this experiment. The work was begun on board the U. S. S. *Relief* in June of that year. The objects of the study were, first, to determine the immunity conferred by tetanus toxoid; second, the number of injections necessary and the optimal interval of time between injections, and, third, the persistence of immunity. The toxoid had previously been tested on animals and also on small groups of volunteers among the laboratory personnel and no unfavorable results followed. Although some workers had reported the successful production of varying degrees of immunity with injections at weekly intervals (Lincoln and Greenwald (1)), other unpublished work indicated that longer intervals were probably more effective.

After this study had been in progress for over a year, we were furnished a supply of a newly developed alum-precipitated toxoid (A. P. T.) which was apparently more highly potent in immunizing power than the plain toxoid. Consequently additional volunteers were obtained and the plan in one of the original groups was altered to study the effect of the new toxoid.

Finally all groups previously immunized by whatever plan or type of toxoid were titrated for antitoxic strength at an interval which varied from 9 to 17 months after the initial stimulation and from 8 to 16 months after the completion of their basic course of toxoid injections. These individuals were then given an injection of A. P. T. and their blood serum obtained for titration 2 days and 7 days thereafter.

¹ Read at the Forty-fourth Annual Meeting of the Association of the Military Surgeons of the United States at Detroit, Mich., October 1936. Printed in the Military Surgeon for January 1937.

This stimulation (or, "injection de rappel" of the French) was intended to give us the opportunity to observe the rise of antitoxin in the week immediately after an injection, imitating perhaps the stimulation of an active tetanus infection. Certainly this simulated the result in a previously immunized individual to whom an injection had been given as a precautionary measure following a wound with possible tetanus infection.

The original groups were begun with over 140 volunteers. The serum of each person was titrated before immunization was begun and none showed any antitoxic strength. Due to the transfer of personnel, only 47 completed the course of immunization. Of these 47, 31 received a final dose of alum-precipitated toxoid at an interval after the original course. Though our volunteers dwindled considerably as time went on, the final report includes a larger number of results than previously reported in America.

Active immunity against tetanus, as against any other infection, is much more valuable than passive immunity or protection. Passive immunity such as is bestowed by the injection of a prophylactic dose of tetanus antitoxin is maximal (1,500 units) only at the time of injection and progressively diminishes as time goes on. In a few weeks no protection whatsoever remains. Sneath and Kerslake (2) determined that 3 days following an injection of 1,500 units of tetanus antitoxin only 0.1 to 0.25 units per cubic centimeter of serum remained in the blood. This represents a loss of from one-half to two-thirds of the amount injected in even this short time.

Active immunity, produced by the introduction of an organism or its products into the body, predisposes to the more rapid development of antibody titre upon the subsequent exposure to that particular antigen. Upon this fact is based our idea of the development of resistance to disease following the natural or artificial introduction of an antigen.

Apparently the first attempt at active immunization of men against tetanus was made by Louis Bazy (3) in 1926. He injected tetanus toxin treated with iodine. Ramon (4) (5) (6) first suggested (1924 and 1926) that toxoid (anatoxin) be used for active immunization against tetanus. In 1933 (7), he reported that using associated vaccines, that is, mixtures of two toxoids or a microbic vaccine and a toxoid, that he obtained antitoxic responses as high as from 0.1 to 1 unit per cubic centimeter of serum and that when later these individuals were given a further provocative injection their serum antitoxin was again definitely and markedly increased.

In America, Lincoln and Greenwald (1) (1933), Bergey and Etris (8) (1933), Sneath (9) (1934), and Sneath and Kerslake (2) (1935) reported results using tetanus toxoid for active immunization. Lincoln and Greenwald reported on 18 human cases, Bergey and Etris

reported results in laboratory animals, Sneath and Kerslake reported on 29 volunteers. As Sneath (9) said:

It will be appreciated that the number submitting to immunization in any one laboratory is much more limited than is the case with diphtheria toxoid, so that an adequate evaluation of tetanus toxoid can be made only by the combined experience from many places.

The reason for this difficulty in securing tetanus toxoid results is that there is no simple method (such as the Schick test in diphtheria) by which immunity to tetanus may be determined. Blood must be drawn and the antitoxic strength of the serum titrated by the protection afforded animals against toxin of known strength.¹

The process of accumulating information on tetanus toxoid immunization has been really no more than well begun and although, in the total needed, this series is small, the following points may be noted. A short interval of 2 weeks between injections, as used in group IV, does not appear to be as effective as the longer intervals used in the other groups. This is indicated by the lower average maximum response to the basic course in group IV (0.025 units) as compared to that obtained in groups II, II-A, and III (0.055, 0.1, and 0.053 units).

Group II-A, which had an 8 weeks interval between the first and second injection, obtained a much better average maximum response to the basic course (0.1) than did groups II and III (0.055 and 0.053) with 5- and 6-week intervals. On the other hand, it is definitely shown that no matter what interval was used in the basic course of injection or how low the level of antitoxin at the time of the final or secondary stimulation injection, that the antitoxin titer rose in 7 days or less to highly effective levels. Group I averaged 4.4 units of antitoxin per cubic centimeter of serum; Group II averaged 2.55 units; group III, 4.0 units; group IV, 2.18 units; and group V, 9.6 units, with one individual going as high as 15 to 25 units and another to the phenomenal level of 25 to 50 units per cubic centimeter of serum.

To appreciate the really considerable amount of antitoxin these figures represent, it must be realized that tetanus antitoxin is measured in units, each of which equals approximately 1,000 minimal

¹ *Method of titration.*—Samples of serum from volunteers before immunization were tested by injecting subcutaneously into 20-gram mice mixtures of one mouse M.L.D. of toxin with 0.5 cubic centimeter of undiluted serum. Other samples which were expected to be very low in antitoxin content were tested in mice by injecting mixtures of various serum dilutions with one mouse M.L.D. of toxin. If 0.5 cubic centimeter of a 1:5 dilution showed definite protection against one mouse M.L.D. of toxin, the serum was estimated to contain possibly 0.001 unit of antitoxin per cubic centimeter and this premise was used as a basis for estimating potencies of sera which protected in higher dilutions than 1:5. These potencies were recognized as but approximations but were regarded as a reasonable basis for comparison on a series of samples all tested in the same way.

The samples which were expected to contain more than a slight trace of antitoxin were tested in guinea pigs according to the National Institute method which takes as 0.1 unit that amount of serum which gives definite protection in 350 gram guinea pigs against a test dose of standard dried toxin, supplied by the National Institute. As this test dose is about 100 M.L.D.'s, unit fractions smaller than 0.1 could be approximately measured by varying the number of M.L.D.'s used in the serum-toxin mixtures injected

lethal doses (guinea pig) of toxin. For example, 1 cubic centimeter of serum containing one-tenth (0.1) of a unit of antitoxin contains the amount necessary to protect a guinea pig against 100 minimal lethal doses (100 M.L.D.) of toxin. An M.L.D. is that amount of toxin which will kill a 350 gram guinea pig in just 96 hours. To calculate the total amount of antitoxin in an individual's body, one simply multiplies the titre of 1 cubic centimeter by the total volume of serum which is approximately one-half of the blood volume. The American unit of antitoxin is equivalent to more than twice the international unit.

There were two individuals who, on the second injection of plain toxoid, had urticarial reactions. These were promptly controlled by injections of epinephrine. There were no such allergic responses to the alum-precipitated toxoid.

In a few instances systemic reactions, manifested by a slight rise in temperature, were observed. A few others merely complained of moderate malaise. The refined toxoid (alum-precipitated toxoid) produced some induration at the site of injection. This disappeared in 48 hours, when the injection was given intramuscularly, but persisted for a longer time when the injection was subcutaneous. The intramuscular route is therefore preferred. When the danger of anaphylactic reactions and serum sickness from the administration of tetanus antitoxin is remembered, the freedom of toxoid from such dangers again recommends it as the method of tetanus prevention.²

We do not know as yet how long the immunity induced by tetanus toxoid persists, however, as time goes on, observation will be made on the groups which have been studied in various laboratories. We do know, however, that the immunity persists relatively undiminished for from 1 to 2 years, with a marked immunity still present after 4 years (7), and that such immune individuals respond rapidly to secondary stimulation, that is, toxoid injection, and presumably to a tetanus infection, with a rise within a week's time to highly protective levels.

² Preparation of toxoid.—Tetanus toxin with a minimum toxicity of 10,000 M.L.D. per cubic centimeter and a minimum lethal dose of 0.03 cubic centimeter was used. Formalin 0.3 percent was added to the toxin and it was incubated at 37° C. The toxin was detoxified in this way until 10 cubic centimeters caused no tetanic symptoms when injected into a guinea pig. An estimate of the immunity value of the toxoid was made by injecting a number of guinea pigs with 1 cubic centimeter and after 30 days bleeding the animals and determining the actual antitoxin content of the blood. The plain toxoid used in this series of human volunteers produced 0.5 unit of antitoxin in such a test.

The alum-precipitated toxoid was prepared by precipitating the plain toxoid with an equal volume of 4 percent solution of potassium aluminum hydrate. The pH reaction of the toxoid was adjusted to approximately neutral, equal volumes of the potassium alum solution added and heated at 45° C. for 3 hours. The pH of the toxoid was then adjusted to pH 6.2 which caused a complete precipitation. The precipitate was then washed in saline and centrifuged three times. The toxoid precipitate was then made up to the original volume with saline solution. This toxoid after being treated as above produced nine units of antitoxin in guinea pigs with one injection.

Indeed, Ramon and Zoeller (7), state:

To judge from the condition in the horse (tolerance of injection of a mass of tetanus spores if the serum neutralizes one single lethal dose of toxin while a nonvaccinated horse succumbs) this antitoxic titre is still perfectly sufficient to protect these individuals against tetanus.

This was said of sera neutralizing from 10 to 100 minimal lethal doses (guinea pig) that is, having from 0.01 to 0.1 unit of antitoxin per cubic centimeter of serum.

Until wider experience is gained and more is known of the persistence of immunity in toxoid-treated individuals it has been suggested that, to make assurance doubly sure, when a previously immunized individual receives a wound with possible tetanus infection, that he be given another injection of toxoid instead of the customary prophylactic dose of antitoxic serum. This will probably raise his immunity to a higher level, protecting him from his immediate danger as well as from subsequent tetanus infections. This obviates, of course, all danger of serum reactions or anaphylaxis. Should it be deemed advisable, an injection of antitoxic serum might be given in one arm and toxoid in the other. The action of one does not interfere with the other's activity in any way.

Toxoid immunization has been advocated particularly for those occupations which are continually exposed to wounds, large or small, with contamination from the soil. This group including for example farmers, stockmen, laborers and gardeners must now be enlarged to include the entire motoring public. Virtually every highway accident with human injury requires tetanus prophylaxis.

Children are probably the age group most constantly menaced by tetanus infection from soil contamination of wounds. Cultivated soil is universally contaminated with animal excreta. Tetanus organisms (*Cl. tetani*) are presumed to be present in all such excreta. The military groups, Army, Navy, and Marines, which may be considered a cross section of the general population, are at times exposed to extraordinary tetanus infection hazards in time of war, as well as in peacetime activity in the field.

If each recruit in training were given two injections of refined tetanus toxoid (A. P. T.) 8 weeks apart we should soon have a body of immune men. Should any of these be subsequently injured in either war or peacetime activities, evidence now indicates that he should not only be well protected against infection but should he receive another injection of A. P. T. his immunity would be subsequently increased for future protection. All of this of course would be without danger of anaphylaxis or serum sickness, an ever-present menace when using antitoxic serum.

The stability and heat resistance of the alum-precipitated tetanus toxoid as compared with tetanus antitoxin (serum), also should be

considered. It has been found that the toxoid is very stable while the antitoxin, as is well known, must be carefully refrigerated to avoid rapid deterioration. Toxoid in the alum-precipitated state will stand temperatures of 60° to 70° C. for a short period of time with little deterioration. It apparently is as stable or more so than alum-precipitated diphtheria toxoid, which has been incubated at 37° C. for several months without loss of any of its antigenic properties.

Further experiments on thermostability are now in progress. This characteristic of alum-precipitated toxoid should be particularly valuable when operating in the field with men who have been previously immunized. If when a man was wounded it was desired to make doubly sure of his immunity by giving a "pick-up" dose of toxoid, thermostable A. P. T. could be depended upon. On the other hand antitoxic serum might be worse than useless if not well refrigerated and potent.

Tetanus, even after antitoxin prophylaxis, is a distressing, but fortunately uncommon surgical complication. This phenomenon of late development takes place in wounds in which probably the spores, having been well isolated or encapsulated, have undergone delayed germination and reached full development only after the temporary protection of the serum has faded. Tetanus developing after reoperation of amputations or war wounds must be guarded against by repeated prophylactic injections of antitetanic serum. This substitution of active tetanus toxoid immunity for antitoxin prophylaxis would obviate the above undesirable procedure. It would do away with the danger of serum allergy and would prove more economical, as the production of toxoid is much less costly than the production of an immune serum such as tetanus antitoxin.

SUMMARY AND CONCLUSIONS

1. Ramon proposed and developed tetanus toxoid (anatoxin) to replace, by persisting active immunity, the temporary passive immunity afforded by injections of tetanus antitoxin.
2. Work with tetanus toxoid and refined (alum-precipitated) toxoid indicates that satisfactory immunity can be developed with tetanus toxoid.
3. Alum-precipitated tetanus toxoid is a much more potent antigen than the unrefined toxoid.
4. Alum-precipitated tetanus toxoid is remarkably thermostable. This property of heat resistance makes its use possible in the field or in locations where refrigeration is not available.
5. Intervals of 6 to 8 weeks between injections are considered more effective than shorter intervals.
6. Reactions in this series were negligible, consisting of local induration at the site of injection and general slight malaise with occasional slight elevation of temperature.

7. Local induration, when the injections were given by the intramuscular route, disappeared in 48 hours. When they were given subcutaneously the induration lasted longer.

8. Two urticarial reactions were experienced with plain toxoid, none with refined toxoid.

9. Secondary stimulation at a long interval following the primary stimulation is effective in quickly raising immunity to a high level.

10. No individual was found in all those tested who failed to respond to immunization. That is, no one in this series was found to be refractory to toxoid immunization.

11. It is believed that immunization against tetanus by toxoid injections could advantageously be substituted for the use of tetanus antitoxin (passive temporary immunity) in certain selected groups.

GROUP I.—Antitoxin titrations

[Units per cubic centimeter of serum]

Volunteers no.	A	B	C*	D	E	F
2-I.....	0.01	0.20	0.50	0.04	0.01-0.04	3-5.0
5-I.....	.01	0.10-.20	1.0	0.10-.25	.01-.25	1.0
6-I.....	.01	.20-.50	-----	.25	.25	5-8.0
13-I.....	.01	.50-1.0	-----	.50	.50	3-4.0
15-I.....	.01	.50-1.0	1.00-2.0	.25	.25	5-7.0
17-I.....	.01	2.0	2.00-3.0	.25	.25	5-10.0
19-I.....	.01	.20-.50	.50-1.0	.10-.25	.10	3.0
24-I.....	.01	-----	-----	.10	.10-.25	3-5.0
29-I.....	.01	.50-2.0	1.00-2.0	-----	-----	-----
Average.....	.01	.78	*1.30	.217	.215	4.40

1 cubic centimeter of old toxoid given as "sensitizing" dose, 8 months' rest, then 2 doses of alum-precipitated toxoid with 6-week interval between doses. Titration before each dose (A and B) and 10 weeks after second dose of alum-precipitated toxoid (C*). Finally 17 months after initial injection or 8 months after third injection, a dose of alum-precipitated toxoid was given with titrations before (D), 2 days after (E), and 7 days after the injection (F).

The titration giving the highest average response to the basic immunization is indicated by asterisk ().

GROUP II.—Antitoxin titrations

[Units per cubic centimeter of serum]

Volunteers no.	A	B	C*	D	E	F	G
11-II.....	0	0.001	0.01-0.20	0.04	0.01-0.04	0.01-0.04	2-3.0
14-II.....	0	.001	.01-.04	.01-.04	.01-.10	.01	.5-1.0
25-II.....	±	.005	.10	.04-.10	-----	-----	-----
33-II.....	0	.001	.01-.10	.04-.10	-----	-----	-----
38-II.....	0	.02	-----	-----	.01	.04	1-2.0
40-II.....	±	.002	.01-.04	-----	-----	-----	-----
41-II.....	0	.001	.10	.04-.10	.04	.04	3-5.0
43-II.....	0	-----	.01	.01-.04	.04	.04	3-5.0
Average.....	±	.002	*.055	.05	.035	.031	2.550

3 doses (1 cc each) of old toxoid; 5-week interval between first and second, and 6-week interval between second and third were given in the basic course.

Titration.—A, 5 weeks after first dose (just before second was given); B, 6 weeks after second; C*, 24 weeks after third; D, 35 weeks after third; E, 17 months after first or approximately 14 months after completion of course of 3 injections. At this time (17 months after first injection) an injection (1 cc) of alum-precipitated toxoid was given, following which titrations were made at 2-day interval (F) and 7-day interval (G).

The titration giving the highest average response to the basic immunization is indicated by asterisk ().

HALL—TETANUS TOXOID

GROUP II (A).—*Antitoxin titrations*

[Units per cubic centimeter of serum]

Volunteers no.	A	B	C	D
70-II (A).....	0	0.01	.....	0.04-0.10
82-II (A).....	±	.04	0.10-0.20	.10- .25
95-II (A).....	±	0.10- .25	.10- .20	.04- .10
Average.....	±	.070	.15	.10

3 injections (1 cc each) of old toxoid; 8-week interval between first and second injections, 6-week interval between second and third.

Titrations.—A, 8 weeks after first dose; B, 6 weeks after second dose; C, 19 weeks after third dose; D, 49 weeks after third dose.

GROUP III.—*Antitoxin titrations*

[Units per cubic centimeter of serum]

Volunteers number	A	B	C	D	E*	F	G	H
12-III.....	0	0.0004	0.040	.....	.....	0.01	0.10-0.250	3-5.0
44-III.....	0	.005	.010-0.10	.....	.....	.010- .04	.01- .040	5.0
45-III.....	0	.001	.01	0.01	0.01	.....	.....	.....
47-III.....	0	.020	.010- .04	.....	.....	.....	.....	.....
48-III.....	±	.002	.01	.04	.....	.....	.....	.....
49-III.....	0	.005	.100- .25	.01- .10	.....	.....	.....	.....
50-III.....	0	.005	.010	.....	.04	.....	.....	.....
53-III.....	±	.....	.010- .10	.....	.040- .10	.....	.....	.....
54-III.....	0	.001	.010	.010- .10	.010- .04	.010- .04	.02	3.0
55-III.....	±	.002	.040	.010- .02	.040- .10	.....	.....	.....
56-III.....	0	.....	.010	.010	.010- .040	.....	.....	.....
101-III.....	0	.001	.010	.020	.010- .04	.....	.....	.....
Average.....	±	.004	.035	.030	*.053	.050	.070	4.0

3 doses of old toxoid; 6-week interval between first and second injections and 2-week interval between second and third injections were given in basic course.

Titrations.—A, 6 weeks after first dose, just before second was given; B, 2 weeks after second dose, just before third was given; C, 6 weeks after third dose; D, 4 months after third dose; E*, 10 months after third dose; F, 17 months after first dose and just before an injection of 1 cubic centimeter of alum-precipitated toxoid; G, 2 days after the dose of A.P.T.; H, 7 days after the dose of A.P.T.

* The titration giving the highest average response to the basic immunization is indicated by asterisk (*).

GROUP IV.—*Antitoxin titrations*

[Units per cubic centimeter of serum]

Volunteers number	A	B	C*	D	E	F	G
16-IV.....	0	0.00040	.....	0.010	0.010	0.040-0.10	3 -5.0
46-IV.....	±	.00100	0.010-0.04	.010- .04	.010	.010	.25- .5
Averages.....	±	.00070	.025	.017	.010	.040	2.180

3 doses of old toxoid with 2-week intervals between first and second doses, and between second and third doses, were given in basic course.

Titrations.—A, 2 weeks after first dose; B, 2 weeks after second dose; C, 2 weeks after third dose; D, 10 months after third dose; E, 17 months after first and 16 months after third dose, and just before an injection of A.P.T.; G, 7 days after dose of A.P.T.

* The titration giving the highest average response to the basic immunization is indicated by asterisk (*).

GROUP V.—*Antitoxin titrations*

[Units per cubic centimeter of serum]

Volunteers number	A	B *	C	D	E
108-V	0.010	0.10-0.50	0.010-0.040	0.040	3-5.0
111-V	.010	.25-.50	.010-.040	.010	2.0
112-V	.010	.25-.50	.040	.010-.04	5-8.0
117-V	.010	1.0	.040-.10	.040	10-15.0
120-V	.010	.50-1.0	.040	.040	8.0
121-V	.010	.5	.040	.040	8.0
122-V	.010	.10-.25	.010-.04	.010-.04	3-5.0
124-V	.010	.50-1.0	.040	.010-.04	15-25.0
129-V	.010	.10	.040	.010-.04	5-8.0
131-V	.010	.50-1.0	.010-.04	.010-.04	10.0
133-V	.010	.10-.25	.010-.04	.010	1.0-2.0
134-V	.010-.10	.5	.110	.10	25-50.0
136-V	.100	.25-.50	.010	.010	3-5.0
Averages.....	.010	*.40	.039	.032	9.60

2 doses of alum-precipitated toxoid (A.P.T.) with 6-week interval between injections in basic course. Titrations.—A, 6 weeks after first injection; B, 6 weeks after second injection; C, 9 months after first injection and just before the final repeat or stimulation dose of A.P.T.; D, 2 days after repeat dose of A.P.T.; E, 7 days after repeat dose of A.P.T.

The titration giving the highest average response to the basic immunization is indicated by asterisk ().

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THE NAVY AND APPENDICITIS

By LUCIUS W. JOHNSON, Captain, Medical Corps, United States Navy, and HORACE R. BOONE, Commander, Medical Corps, United States Navy

It is with considerable hesitancy that one approaches this subject, fearing to be the author of just another article on appendicitis. We are emboldened to do so, however, on the completion of a tour of duty of 43 months on the surgical service of the United States Naval Hospital, San Diego. During this time 972 cases of appendicitis were operated on with 4 deaths, 2 of which were due to peritonitis, 1 to paralytic ileus, and 1 to pulmonary embolism. There were no deaths during the last 31 months of this period.¹

There are many reasons why the death rate for appendicitis in the Navy should be much lower than the country-wide average. So,

¹ During a subsequent period of 15 months on the fleet hospital ship, U. S. S. *Relief*, the writers have continued to employ these same principles. They have treated an additional 309 cases of appendicitis, with no deaths. Drainage was employed in only two cases, both walled-off abscesses.

if we show better figures than some others, it does not indicate individual excellence but rather the superiority of the organization to which we belong. Some of the factors in favor of the appendicitis patient in the Navy as contrasted with the civilian seem worthy of brief mention.

(a) Skilled advice is always available to the Navy man without cost and this matter of cost is often the thing that keeps the patient in civil life from seeking proper medical care until the disease is well advanced. Then, too, the doctor who advises the Navy patient has no financial interest in deciding whether he should receive medical or surgical treatment, or whether he should be hospitalized or not. Too many patients are imbued with the prevalent idea that the financial aspect may sway the doctor's judgement. Removing the financial consideration means that the patient comes earlier to the doctor.

(b) In the Navy, both the doctors and their prospective patients are pretty thoroughly indoctrinated with the idea that pain in the belly frequently means appendicitis and that early surgery is the best treatment. So most of our patients come to operation in that stage of the disease when it is still a localized process, limited to the appendix. Compare this happy state of affairs with the statement of Weeden (1), that more than 75 percent of his cases did not enter the hospital until the third day or later. Stanton (2), in one of the most intelligent and reasonable articles we have seen on the subject, gives the following figures compiled from reports of more than 16,000 cases:

Operated on—day of attack	Cases	Deaths	Death rate percent
First.....	1,507	20	1.3
Second.....	912	33	3.6
Third.....	663	56	8.9
Fourth.....	356	46	12.9
Fifth.....	442	49	11.6
Sixth.....	346	29	8.4
Seventh, eighth, or ninth.....	178	5	2.8
Tenth day or later.....	288	7	2.4

This clearly illustrates the advantage enjoyed by Navy patients in their early contact with the surgeon.

(c) Cathartics are not so generally used in the early treatment of appendicitis in the Navy. Most of our doctors, nurses, and corpsmen understand the dangers of purgation in appendicitis. Most sickbays have an order that cathartics are not to be given without an order from the doctor and especially not to be given to any man with a pain in his belly. In spite of this widespread knowledge, we do get a certain number of patients who have received cathartics, but not, we believe, as many as are seen by the average surgeon in civil life. It is generally recognized that administration of cathartics is the greatest death-producing factor in appendicitis. Heyd (3) states that, of 402

patients who had appendicitis but received no laxatives, 1 out of 80 died; among 992 who had 1 laxative, 1 out of 14 died; among 990 patients who took more than 1 laxative, 1 out of 7 died. It is usually the patient himself who follows the advice so freely given by newspaper and radio and takes the laxative to relieve his pain. So the more thoroughly we can spread the knowledge of the dangers of this medication in the Navy, the fewer men will we lose from appendicitis.

(d) Surgery is done by younger men in the Navy. When the age of crystallization arrives and a man ceases to progress, he is gently eased out of the surgical field and relegated to other duties, where his surgical judgment is available to the younger men for consultation when needed, but he does not dominate. This control of surgery by younger men means that keenly competitive and well-trained men are constantly striving for better results and searching for improved methods, under the observation of men of years of experience. A high average of surgery is the inevitable result.

In contrast to this, one observes that, in many civil communities, even in large cities and teaching institutions, surgical thought is dominated by much older men. Many of them are in their sixties or seventies, frequently men of strong personality who have ceased to progress and have not assimilated new ideas for many years. This point was forcibly emphasized at a recent sectional meeting of the American College of Surgeons, when several young men, in discussing papers on appendicitis, said that they were forced to follow practices, such as routine drainage and burial of the appendiceal stump, which they considered antiquated. They were afraid to adopt more modern methods because the older men would criticise them freely and publicly, testify against them in lawsuits and possibly wreck their careers if they did not follow the time-honored ritual of their elders. So it appears that control of surgery by younger men is a distinct advantage to the Navy patient.

(e) The great number of what might be called prophylactic appendectomies in the Navy reduces the death rate. Not only do these interval appendectomies have a death rate approximating zero, but the absence of the appendix saves the patient from later attacks. It is the custom to send to the hospital immediately any man with symptoms which might be appendicitis. Once in the hospital with that diagnosis on record, most medical officers feel that they are assuming an unwarranted responsibility for the man's future health and safety if they restore him to duty without first removing his appendix. Of course, if study shows that the symptoms are due to some entirely unrelated cause and the appendix is innocent, the operation is not held to be necessary. When operation is recommended to the patient, most men choose to have the appendix removed

under ideal conditions rather than run the risk of an attack at sea. Navy men are so often removed from the possibility of surgical intervention under proper conditions that absence of the appendix is distinctly advantageous to the individual as well as to the Navy.

After acknowledging the favorable influence of these potent factors, we wish to emphasize the importance of the following tactical details in securing a low death rate:

1. Use of the Schilling count in diagnosis.
2. McBurney incision as a routine, others when indicated.
3. Leaving the stump of the appendix unburied.
4. Closure without peritoneal drainage except for localized abscesses.
5. Intravenous fluids in large volume and continuous duodenal drainage.

Eliason and Ferguson (4) have noted the interesting fact that, from 1915 until recently, there has been a marked decrease in the number of articles published on the subject of appendicitis, which indicates a lessened interest in the subject from a progressive standpoint; and that, during this period, there has been a steady increase in the mortality rate from this disease. They state that a review of the vital-statistics records shows a 31-percent increase in the death rate in the United States during the period from 1915 to 1926.

They believe that part of the increase is accounted for by the fact that appendectomy is no longer considered a major operation. It has lost its terrors and, today, is undertaken by hundreds of inexperienced operators as lightly as they undertake an amputation or a herniorrhaphy. The increase has occurred in inexperienced hands while, in big clinics and when done by experienced men, the mortality has decreased.

For the Navy, the statistics vary little from year to year, the figures for the last 5 years available showing the number of deaths from appendicitis of all types to be well under 1 percent of operations for the disease.

Year	Admissions	Operations	Deaths	Year	Admissions	Operations	Deaths
1929.....	1,511	1,286	9	1932.....	1,540	1,456	10
1930.....	1,585	1,505	14	1933.....	1,646	1,542	11
1931.....	1,494	1,355	10				

Type of operation.—It does not seem logical to adopt any one type of operation as a routine, to the exclusion of all others. Careful study of the various methods will reveal that each has advantages and disadvantages; that the disadvantages can best be neutralized by choosing the incision most suitable for the individual case. Thus

there appear to be definite rules for electing the McBurney, the transverse or the right rectus operation.

McBurney's gridiron incision is the simplest, safest, and best for most cases in which the diagnosis of appendicitis can be definitely reached, and particularly in cases of the acute suppurative type. It avoids injuring important structures in the abdominal wall. It brings one down to the outboard side of the cecum, which is the safest approach in the presence of suppuration. It permits appendectomy and drainage without breaking down the adhesions which prevent the spread of infection toward the midline. It allows extraperitoneal approach to many retrocecal abscesses, so that one can open directly into the abscess without any intraperitoneal manipulation.

Monte Reid (5) believes that the type of incision plays a definite role in the mortality rate of acute appendicitis and he makes the illuminating statement that "the death rate for all forms of appendicitis (unruptured and ruptured; with abscess and with peritonitis) treated in the Cincinnati General Hospital has been reduced 50.3 percent since the routine of a rectus incision was abruptly and completely changed to that of a McBurney incision." He gives the following advantages of the latter incision: (1) There is less soiling of the general peritoneal cavity; (2) there is less necessity for handling the intestine, for usually it is necessary to touch only the cecum and appendix; (3) with the modern means of suction the traumatizing effects of gauze pads can be eliminated; (4) drains can be placed in contact with the parietal peritoneum where they soon become in fact extra-abdominal and are not surrounded by intestines; (5) wound complications are less; (6) convalescence is shorter; and (7) the healed wound is less disabling. All of this we heartily endorse.

An even greater contrast is noted by Shute (6) in a recent article when he presents the following statistics:

Mortality rates

Type of case	Rectus incision	McBurney incision	Type of case	Rectus incision	McBurney incision
	<i>Percent</i>	<i>Percent</i>		<i>Percent</i>	<i>Percent</i>
Diffuse peritonitis.....	33.3	16	Early localized abscess....	33.3	6.6
Localized peritonitis.....	30	6	Total mortality rate.....	31.8	9.5

The transverse incision had a considerable vogue in the first decade of this century but fell into disuse after the death of Gwilym G. Davis, of Philadelphia, its principal protagonist. Rockey (7) later revived it, and, since his paper in 1924, it has enjoyed increasing popularity. This incision offers advantages over the gridiron in certain cases. Chief among them is the excellent exposure and the wide area within reach of the exploring finger. It is most useful for

fat persons, for interval operations, and for cases where the exact diagnosis cannot be made but the trouble is probably in the right lower quadrant. When a high-placed appendix is encountered, or an ileo-cecal tuberculosis which has to be resected, one may well be thankful that he has used a transverse incision instead of a gridiron. Rockey recommends this operation especially for suppurative appendicitis and offers a large number of successful cases in its support. But we see definite disadvantages in its use in the presence of suppuration. It exposes the dangerous area inboard of the cecum to contamination and also opens up the muscle planes and the rectus sheath to infection. These tissues lack the powerful defenses against infection by intestinal bacteria which the peritoneum enjoys, and one who has witnessed the rapid digestion of muscle and fascia which follows such infection may well hesitate to use this route in the presence of infection. But it is strongly recommended for interval operations and for chronic appendicitis. By this latter term, we refer to cases in which mechanical factors, which interfere with the normal filling and emptying of the organ, are the dominant factor.

The right rectus incision is used only when appendectomy is a minor part of a more formidable operation. We never employ it for simple appendectomy or when suppuration is anticipated. The plea that one should make a wide exploration through such an incision whenever an appendix is to be removed does not seem logical when one considers the difference in danger between the rectus and the McBurney operations. Reid (5) showed a very considerable reduction in death rate after changing his routine from a right-rectus incision to the gridiron. In 409 cases there was a mortality of 9.8 percent when the rectus incision was routine, while 1,626 cases had a mortality rate of 5.2 percent when the McBurney incision was routinely used. The rectus incision has certain very definite disadvantages. It is a more formidable operation and more exhausting to the patient, who is already engaged in a severe battle with infection. It involves more extensive intraperitoneal manipulation and spreading of the infection. It is more prone to produce serious herniation if there is extensive infection of the tissues of the abdominal wall.

Burying the stump of the appendix was formerly regarded as an essential part of the operation, but for several years, it has been abandoned by more and more surgeons. We do not bury the stump for the following reasons:

- (a) It is unnecessary.
- (b) It is dangerous.
- (c) It increases the postoperative discomfort.

That it is unnecessary is evident from the fact that thousands of operations have been done, omitting this step, and no bad results.

have followed this omission. From articles in the literature one gathers that more and more surgeons are abandoning it each year.

It is dangerous because it adds to the possibilities of infection. We believe that many of the unexplained infections of the tissues of the abdominal wall result from it. We know that intestinal bacteria are found in all layers of the intestinal wall within the peritoneum. We are instructed that stitches in the intestinal wall should penetrate to the submucosa if they are to hold. So the first stitch taken in the purse-string suture infects the suture material as it passes through the wall of the gut. As this suture material touches the surgeon's glove or the surrounding tissues it infects them. The intraperitoneal structures have sufficient resistance to intestinal bacteria so that serious infection rarely occurs, but the muscular and fascial layers of the abdominal wall lack this resistance and so infection follows. An excellent discussion, giving both sides of this question will be found in Horsley's *Operative Surgery* (8). He concludes:

If we were to establish ideal conditions for the formation of an abscess we would probably prescribe, first, the diminution of the blood supply to the tissues in which the abscess is to be located; second, the presence of necrotic material; and third, the formation of a closed sac. These conditions are filled when the stump of the appendix is buried, for the purse string not only forms a closed sac in which the stump is enclosed but it cuts off some of the blood supply that must reach the base of the stump to produce repair.

It undoubtedly increases the postoperative discomfort. One of us several years ago was doubtful about abandoning this procedure, so he buried the stump in alternate patients until 50 cases were done, and carefully observed the postoperative course. Long before the series was completed he was convinced that he would never bury another appendiceal stump. The smooth and comfortable convalescence was most convincing and contrasted with the discomfort of those in whom it had been buried. The reason for this is plain when it is considered that the peristaltic waves begin in the tip of the cecum and progress toward the rectum. If there is a purse-string suture invaginating this area, the incipient peristaltic wave is converted into a violent spasm, which produces the characteristic gas pain. One of the most important factors in recovery from any operation on the gastrointestinal tract is early reestablishment of peristaltic currents. This is greatly delayed if the cecum is distorted by a purse-string suture.

Drainage of the peritoneum is recognized by all as an important detail, but there is wide variance in its application. Since the earliest days of operative treatment of appendicitis it has been a question that few could debate with equanimity. Like religion and politics, this subject seems to be one that arouses the most placid and courteous surgeon and makes him a militant advocate of one side or the other whenever it is discussed.

Peritoneal drainage in cases of infection and post-operative pus collections was first used about the middle of the nineteenth century. But only with the recent great increase of abdominal operative procedures during the twentieth century did it become a common procedure.

In reviewing the literature covering the period from 1900 up to the present, one is impressed with the marked difference of opinion expressed about the indications for and the type of drainage to be used. The pendulum swings from one extreme, when practically all cases were drained, to the other, when drainage is seldom used. However, during the last few years, there has been a more pronounced trend away from frequent drainage, and numerous articles have been written on the subject. The ideas expressed, however are not new.

In 1905, Yates (9), following extensive experimental work, published a most excellent and comprehensive article on the local effects of peritoneal drainage and reached certain very definite conclusions. Among them were these:

(a) Drainage of the general peritoneal cavity is physically and physiologically impossible.

(b) Relative encapsulation of the drain is immediate.

(c) Absolute encapsulation occurs early (less than 6 hours in dogs) and can be retarded but not prevented.

(d) The serous external discharge is an exudate due to irritation of the contiguous peritoneum by the drain.

(e) A drain, in the presence of infection, is deleterious to peritoneal resistance.

(f) Peritoneal drainage must be local and, unless there is something to be gained by rendering an area extraperitoneal, or by making a safe path of least resistance leading outside the body, there is no justification for its use.

Later experimenters have verified these findings and have amply demonstrated the futility of peritoneal drainage in diffuse infection.

Reasoning from the clinical aspect of his numerous cases, Blake (10) concluded that—

drains into the peritoneal cavity were unnecessary when, after elimination of the cause of a peritonitis there was no great difference in the appearance of one part of the peritoneum from another. Thus, in an ordinary diffuse peritonitis, drainage was unnecessary, but in a localized peritonitis, as, for example, an abscess, drains should be used.

He was impressed by the needlessness and actual harm of drainage when there was no necrotic tissue remaining, and found a marked difference in mortality in favor of nondrainage between drained and undrained cases of bad diffuse peritonitis.

We were greatly impressed by the logic and force of his observations and the authority given to his words by his background, but were

somewhat timid in adopting his procedure. Only through several years of gradual abandonment of drainage have we become convinced of the correctness of his reasoning.

Rhodes (11), in tabulating the answers to a questionnaire sent to 121 recognized surgeons of the California State Medical Society, provides the following figures:

Do you drain the peritoneal cavity after operations for appendectomy in:

(a) Simple, acute, nongangrenous appendicitis: Yes, 2; no, 119.

(b) Gangrenous, nonperforated appendicitis: Yes, 26; no, 88.

(c) A perforated appendix with, early local peritonitis, yes, 80; no, 35; diffusing peritonitis, yes, 104; no, 13; late general peritonitis, yes 107; no, 7.

It is evident, from the answers to these questions, that the majority of surgeons today are not ready to accept and adopt the teaching that drainage is usually useless and frequently harmful. But the number who are willing to consider the possibility that such teaching is correct is undoubtedly increasing, and surgical literature of recent years shows a trend toward gradual abandonment of routine drainage. It appears to be a battle of youth against age, with the younger men essaying closure without drainage and finding it excellent, while the embattled seniors fervently uphold drainage.

We have arrived at our present position with regard to drainage by a gradual progression. Formerly, we drained all cases with localized abscesses; all with perforated appendices and all with cloudy peritoneal fluid. But we came to believe that we were thus draining away the body's defensive agents, which it had mobilized at great cost and could ill afford to lose. So we gradually abandoned drainage. Each year we omitted drainage in cases that formerly would have been drained and there was never a case in which we had reason to regret the omission. We now drain only cases with oozing which cannot be controlled, abscesses, and those cases in which exploration indicates the wisdom of not removing the appendix. During the period covered by this paper, less than one-half of 1 percent of our cases were drained.

It is highly probable that the most ardent advocates of drainage have never given fair trial to the method of closure without drainage. Most of them recommend giving large quantities of fluid by the intravenous route during the postoperative period and we believe that carefully controlled experiments would show that it is the large volume of fluid and not the drainage that promotes recovery.

In our 972 cases, drains were used within the peritoneum in 29 cases and 2 deaths occurred in this group. No deaths occurred during the period from August 1932 to April 1935, during which time drainage was used with diminishing frequency.

Postoperative treatment.—In all cases of peritonitis this is a matter of the greatest importance. It is essential that the treatment start immediately after operation and that all details be carefully supervised by competent persons, who can immediately correct anything that goes wrong.

First, and perhaps most important, is the free use of fluids. In order to prevent dehydration, promote elimination, maintain the acid-base equilibrium, and prevent excessive lowering of chlorides, large quantities of fluid must be given. Four to six thousand cubic centimeters are required each 24 hours in cases with normally functioning heart and kidneys and this quantity can be conveniently given by combining the intravenous and subcutaneous routes.

The intravenous drip or venoclysis method affords a way of giving large quantities slowly but is not without its difficulties. It requires constant care to maintain the proper balance between the weight of the solution in the tube and the intravenous pressure. If the tube is held too high, the fluid will enter the vein too rapidly, while if it is allowed to sag below the level of the arm, blood will enter the needle and obstruct it by clot. Another objection is that it is necessary to splint the patient's arm, which increases his discomfort. Solutions of glucose of greater strength than 5 percent will thrombose the vein in a comparatively short time. However, under careful supervision, large quantities of fluid may be safely given by this method.

The usual method of intravenous infusion is by giving the fluid more rapidly, without the use of the drip bulb. We have been accustomed to give 1,000 cubic centimeters by this method every 8 hours.

The subcutaneous route or hypodermoclysis, using the continuous drip, also offers a method for giving large quantities of fluid. Needles inserted beneath the fascia of the thigh give less discomfort than when they are used in the pectoral region. One may give 2,000 to 3,000 cubic centimeters in 24 hours by this route.

A combination of these various routes may be employed to give large quantities of fluids without great discomfort to the patient. The fluid to be used is another problem.

Sodium chloride in isotonic solution approaches nearer to the nature of normal blood serum than any other fluid commonly used. It contains the necessary water to maintain blood volume, and also the sodium and chlorine ions which are important for the acid-base equilibrium.

Glucose, 5 to 10 percent solution in normal saline, gives a fluid with food value, on which a patient may be carried along for days without any other form of nourishment. However, glucose cannot be extensively used by hypodermoclysis. A solution of 2½ to 5 percent strength may be given by this method, but usually it is painful.

Glucose in plain sterile water, given intravenously, will greatly alleviate thirst.

The second important step in postoperative treatment is the prevention of distention. There is no more distressing sight than a peritonitis patient with an enormously distended abdomen, dyspnoeic from pressure, vomiting large amounts of foul-smelling fluid, and, at the same time, begging for water. This picture, so common in earlier years, we do not now see. Transnasal duodenal-suction drainage, along with the administration of large quantities of fluid, has done more to change the clinical picture of general peritonitis than any other factor.

The Levine tube is inserted through the nose into the stomach and to this is connected a continuous suction produced by water siphonage. The fluid withdrawn from the stomach and duodenum is then re-administered by proctoclysis, thus preventing the effects of excessive loss of duodenal contents.

It is surprising how rapidly abdominal decompression can be accomplished by this means. Water can be freely given by mouth and will be immediately withdrawn by the suction tube. This gives frequent gastric lavage, prevents vomiting, and, at the same time, relieves the patient's thirst.

During this time morphine is given in sufficient doses to keep the patient comfortable. No attempt is made to increase intestinal peristalsis in the early care of general peritonitis cases, but in cases of ileus without peritonitis, pitressin, hypertonic saline, etc., are given.

CONCLUSIONS

1. Mortality rates in the Navy from appendicitis should be, and are, much lower than the country-wide average.
2. The McBurney incision is recommended as a routine for simple appendectomy.
3. The stump of the appendix should not be buried.
4. Intraperitoneal drainage should not be used routinely, only when clearly indicated by localized abscess or uncontrolled oozing.
5. Postoperative use of fluids in large quantities and abdominal decompression by means of transnasal duodenal suction will greatly reduce mortality rates.

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THE SPECIALIST VERSUS THE NAVAL SURGEON

By G. F. COTTLE, Captain, Medical Corps, United States Navy

The primary education of a doctor in the medical school attempts to cover the entire field of medicine, surgery, and public health. Even before graduation most medical students have begun consciously or unconsciously to take more interest in certain specialties of medical practice than in others. Public health and preventive medicine as lifetime objectives attract but few, while the surgical specialties and internal medicine attract large numbers. This tendency to leave the general field is resisted in the medical school by examinations which cover the entire field. During the interne years further resistance to specialization comes from the method of rotation between medicine, obstetrics, and the surgical specialties. Efforts are made in civil life to keep young men in general practice at least for a time after completion of their interne training. Every specialty of medical practice has established standards which tend to delay the transition of the young practitioner from the field of general practice to that of a specialty of medicine or surgery. This tendency toward specialization has brought the patient much that is good. It has encouraged research and developed new methods of diagnosis and treatment. It has improved the teaching in medical schools of both undergraduates and postgraduates. Much has been said about the need for the general practitioner who can enter the home and give any and every member of the family a complete medical service. In the medical and in the lay press much is said which implies that more physicians should be trained for and more should remain in general practice. However, if we look at the general practitioner today do we find that he in himself is self-sufficient? If acute appendicitis or perforated ulcer is diagnosed, is he expected to give with his own hands the necessary surgical treatment? If an eardrum or an antrum or a mastoid must be drained, is he not expected to call in a specialist? If he

makes the diagnosis glaucoma, or iritis, or suspects sympathetic ophthalmia, can he properly assume full responsibility alone when a specialist is obtainable? If he makes a diagnosis of cerebrospinal meningitis, infantile paralysis, diphtheria, smallpox, leprosy, or typhus fever, is he supposed or even permitted without public health supervision to formulate the rules and be responsible for the control of these infections? If he is called to treat a fractured femur, a serious intracranial injury, or a fractured pelvis or spine, can he proceed safely without consultation? Does he maintain an ability to examine the blood by the method of Wassermann or Kahn or to type a blood donor? Is there such a thing as a general practitioner? Do not the complexities of medical practice drive the physician into a form of practice that is somewhat limited? Has not the telephone and the automobile made the old country doctor, the old family physician, into a man dependent upon other members of his profession for many types of medical service? Have not the people at large come to suspect that he who claims to be a general practitioner is, after all, a "jack of all trades", and master of none?

In the medical corps of the Navy specialization has come to be the rule. Young men wish to become identified with the specialty of their choice. The Bureau of Medicine and Surgery assists selected members of the medical corps to take special courses in civil life and places opposite their names in the Register of Officers a number indicating a successful conclusion of such a course. Delay in the process of specialization is necessary in the naval service as it is in civil life. The young medical officer is given a rotation of duty. He seldom can remain long enough in one place or job to satisfy his desire to specialize. If he applies for a postgraduate course he is told that his first course should be the Naval Medical School, where he is given a review in clinical pathology, internal medicine, tropical medicine, hygiene and sanitation, and the surgical specialties. Only after perhaps a second tour of sea duty, and after struggling to keep up an interest in a clinical specialty against what seems to be a system planned to prevent him from attaining his desired opportunity, is he allowed to become an understudy in the specialty of his choice, and even then more time must elapse before he is allowed to have a postgraduate course in that specialty which all along, perhaps for years, has been his desired goal. If specialization is necessary for efficiency, if specialization is the rule in civil life, if postgraduate teaching in civil life is designed to encourage specialization, why does the Medical Department of the Navy seem to resist specialization until enthusiasm tends to diminish and until a sense of frustration enters the minds of some naval medical officers?

The ship is the military unit of the fleet, and the efficiency of those units is the objective of the Navy in peace and in war. The naval

hospital, the naval dispensary, the sick bays of naval stations have important functions to perform, but they exist not for themselves; they exist to support the units of the fleet. Approximately one-fourth of the medical officers of the Navy are at sea. Approximately one-quarter of the first 30 years of a naval medical officer's service life is spent at sea. The duties of a medical officer at sea are stated in Naval Regulations—they require of him a knowledge of matters which in civil practice belong to the many medical and surgical specialties. Is the naval surgeon then just a "jack of all trades" and master of none? The naval medical officer at sea does not need to be a specialist in the civilian sense, but he must specialize in a fashion peculiar to the needs of a ship. Can he take a postgraduate course and thereby become a naval surgeon? Can the Naval Medical School so guide and instruct him as to make of him an efficient naval surgeon? From these sources, and from reading and visiting medical activities ashore he can gradually train himself to be a capable naval surgeon if he visualizes what is needed. On the road to real efficiency as a naval surgeon he sees many inviting signs—surgery; medicine; urology; eye, ear, nose, and throat; roentgenology; psychiatry; obstetrics, etc. A side trip along one of these is what he most desires. It can, however, be but a side trip. He must come back. He must abandon the path toward his chosen specialty and come back to the main road every time he goes to sea. When recalled to the main road will he merely sit there and hope that by another turn of the wheel of chance he will be returned to his chosen field, or will he continue while at sea to strive to advance along the main road in the hope that by that advance he will earn the right to return to his specialty later on? There is on the naval surgeon's road one sign which he must ever keep ahead, that sign is "emergency." It is the business of a naval medical officer to know how to properly and effectively meet any and every emergency that may affect the lives of his officers and men at sea, no matter what specialty of medicine teaches the technique. It is true that when in port, or in company with the hospital ship, emergencies may be met by transfer to the hospital or hospital ship, but there are times when ships must ply the seas alone, and it is when acting alone that the real test of a medical officer's ability as a naval surgeon will come. The emergencies to be met are not many, nor is it impossible to set one's self the task of being fit to meet them. The point is that they are taught in medical schools and postgraduate schools as belonging to different specialties, but at sea, alone with the crew, a medical officer cannot "pass the buck", he cannot call in a surgeon, a specialist of the eye or ear, an internist, a psychiatrist, an officer trained in public health. He must act alone and he should prepare himself for such action.

To list all the emergencies that may arise is impossible and unnecessary but it is possible to list examples to show how all, inclusive of all the specialties, such a list must be. The naval surgeon should be prepared for at least the following: Remove an appendix, sew up a perforated duodenal ulcer, open an ear drum, puncture an antrum, open a mastoid, reduce a dislocation, reduce and splint a fractured femur, diagnose and treat compression of the brain, dilate the iris, treat glaucoma, diagnose and treat sympathetic ophthalmia, treat a gonococcus infection of the eye, relieve acute retention of urine, treat pneumonia, treat uremia, treat a failing heart, handle the insane, and control the spread of communicable disease.

When the young medical officers of the Navy set themselves this goal; when they prepare themselves to assume full responsibility for the emergencies of surgery, medicine, and preventive medicine; when the chiefs of services in naval hospitals and senior medical officers of shore stations hold the officers of the day responsible for an ability to meet and to handle emergencies, we will be consciously preparing medical officers for their primary and essential functions—those of a medical officer of a ship at sea. This objective is not easy of attainment. Properly visualized and properly striven for, it becomes worth one's while. Although not taught in any one school, it is not an impossible objective. It is a specialty in itself different from those of civil life, taking from each specialty that part which is essential to itself.

Parallel to the effort required to fit himself for this duty at sea, a naval medical officer can and should carry a secondary objective—that of excelling so far as may be possible in one of the specialties of civil life. He who adopts a civilian specialty as his primary objective will find his pathway blocked by orders which disturb his progress and dull his enthusiasm. He who strives to attain efficiency in a chosen specialty, and at the same time culls from all specialties those things which he must know to be an efficient naval surgeon, will find his service career happy, stimulating, and in line with his ambition.

AVIATION MEDICINE

By JOHN W. VANN, Commander, Medical Corps, United States Navy ¹

Although comparatively new as a means of transportation and a military arm it can be safely stated now that aviation has already arrived at a place of importance in national and world-wide affairs. As an industry it is rising to a well-deserved position high among the

¹ This article emphasizes the increasing importance and value of aviation medicine and points out the future developments likely to occur. It is the policy of the Bureau of Medicine and Surgery to regard aviation medicine as a definite speciality on an equal plane with other specialties. This field of medicine is one of great promise to young medical officers, giving them an opportunity to early identify themselves with a recognized speciality.

leading industries of the Nation and the importance of the airplane and airship to the national defenses has resulted in new acts being passed recently by Congress which are designed to strengthen those defenses.

Within the service lifetime of a large percentage of the naval medical officers now in the service, changes have occurred which strikingly bear out the increased importance the services and Congress attach to aviation. Most of us can remember when the aviation activities of the Army were a part of the Signal Corps and when the aviation activities of the Navy were divided among three bureaus of the Navy Department, the Bureau of Engineering for motors, the Bureau of Construction and Repair for planes, and the Bureau of Naval Operations for the operation of aircraft. Now we know that the Army has a separate Air Corps and its General Headquarters Air Force, and the Navy has its Bureau of Aeronautics under which all aviation activities are grouped.

What part has aviation medicine played and what part will it continued to play in the development of aviation? With aviation a new specialty in medicine was born, and it has done much to make aviation what it is today. That it will continue to do so no one who has given the matter serious thought can doubt. Its importance has grown apace with that of aviation. As early as 1910, it is stated, the Germans realized that a specialized type of physical requirements and physical observation would be necessary in the selection of flyers, and steps were taken to prepare for such selection. England and France did not realize the necessity for flight surgeons until 1914, and the United States first took such action in 1917 when a board of officers was appointed to draw up the form for physical examination. They recognized that medical officers selected to make this examination should be men especially trained, but it was not until May 1919 that a formal course of instruction for the purpose of training flight surgeons was introduced in the Army. The Air Service Medical Research Laboratory and School of the Flight Surgeon, as it was first designated, was located at Mitchel Field on Long Island for many years. Later it became a special service school named the School of Aviation Medicine, was moved to Brooks Field, and in 1931 to Randolph Field, Tex., where it is an integral part of the Air Corps Training Center of the Army. The War Department has recognized the importance of aviation medicine by having a medical section in the Office of the Chief of the Air Corps, by having specialists engaged in research work at Wright Field, Dayton, Ohio, by having a pool of trained men in the regular service who are graduates of the School of Aviation Medicine, by extension courses for reserve officers, and

by requiring all medical officers on duty at Army air fields to be graduates of the school. Flight surgeons, therefore, are recognized by the War Department to be specialists, and their details are under the cognizance of the medical section, Office of the Chief of the Air Corps.

The Navy has closely paralleled the Army in the field of aviation medicine and has encouraged specialization in that field of medicine. Subsequent to the establishment of the Army School of Aviation Medicine on Long Island a large number of naval medical officers were trained by the Army to become flight surgeons and were officially designated as specialists by the Navy. As these men became mature and experienced they became available as instructors and a course in aviation medicine was added to the curriculum of the Naval Medical School in Washington. There a certain number of medical officers were trained as flight surgeons, and hospital corpsmen received training as aviation technicians. More recently the Army has again placed the facilities of its School of Aviation Medicine at the disposal of the Navy and a few naval medical officers have graduated with the last three classes from Randolph Field. The Navy Department has also recognized the importance of aviation medicine by having a Division of Aviation Medicine of the Bureau of Medicine and surgery and by the detail of flight surgeons to duty on the staffs of aircraft commanders, to duty on aircraft carriers, and to duty at air stations.

What then is this aviation medicine and why should it be recognized as a specialty? Aviation medicine is that field of medicine primarily designed to augment and enhance the specially trained medical man's knowledge of those subjects in medicine which will enable him to do three things, viz: (1) Select the flyer, (2) care for the flyer, and (3) engage in research work on medical aspects of aviation problems. As stated before aviation has been able to progress to its present stage of development because medical men recognized that safety in the air depends upon the careful selection of pilots, and standardized the physical requirements as a basis for selection. In military and naval aviation this is but half the battle for pilots must be maintained at the peak of their physical condition in order to justify, and frequently to actually preserve, their flying status, for an unwell pilot is a menace to himself, his passengers, and to others on the ground. A sound mind and a sound body are essential, and aviation medicine plays an important role in helping maintain the pilots in good physical condition. Much research work has already been done and many of the procedures formerly required as part of the physical examination of candidates for flying, and of pilots, are no longer considered necessary because research has shown their futility or established standards for

guidance. Thus the Barany chair is almost obsolete as far as military and naval examinations are concerned, and the rebreather test for the classification of pilots is not required since the use of oxygen is compulsory at altitudes greater than 15,000 feet. Research work on the carbon monoxide content of the air in cockpits and in hangars, on cold weather flying, on flight clothing and goggles, and many other things has already been done, but much yet remains to be done.

Aviation medicine, therefore, should be considered a specialty, and the specialist, to be known as a flight surgeon or by some other designation, should be recognized as such. He should be a physician, not merely an examiner or a technician, one who has a thorough grounding in general medicine and general surgery. In addition he should have special training in psychology, psychiatry, ophthalmology, otology, cardiology, and physiology. Obviously he cannot specialize in all of these fields but often the flight surgeon is a specialist in one of them in addition to being a flight surgeon. Most important of all he should have some knowledge of, and actual experience in, flying. He need not be a fully qualified pilot, although it appears desirable that a certain number be so trained, but he should fly in order to acquire a better appreciation of the qualities desirable in a pilot as well as how physical defect and impairment affects efficiency in operating the controls of aircraft. Research problems also may require repeated or sustained flights, and in military and naval aviation, tactical exercises or emergencies may require flying on the part of the flight surgeon. Unless he is willing to fly under the same ordinary conditions and with the pilots with whom he is serving, a medical officer should not be encouraged to specialize in aviation medicine. Conversely when he becomes a specialist and the responsibility of passing upon the fitness of a candidate or a pilot devolves upon him he should not only ask himself "Is he fit to fly?" but also "Would I be willing to fly with him?"

The Army School of Aviation Medicine, since the inauguration of the first course of instruction in 1919 to the close of the year 1935, has graduated and designated as "flight surgeon" 174 Regular Army medical officers, 168 Reserves, 27 National Guard, 36 Navy, and 7 foreign medical officers. The Navy at present time has less than 50 medical officers listed as flight surgeons. All are not graduates of the Army School of Aviation Medicine. Several have not been detailed with aviation activities for some time. Prior to August 1935 no medical officers had been under instruction in aviation medicine for several years. The Army is willing to cooperate and has ample facilities for the instruction of several naval medical officers in each of the two classes authorized at Randolph Field each year. Aviation activities

ashore are expanding rapidly in the Navy, and soon more carriers will join the fleet. This writer would like to see and desires to encourage more interest in aviation medicine as a specialty on the part of the younger men. He believes a pool of trained men should be built up, men who are graduates of the School of Aviation Medicine and who have had experience in naval aviation, to the end that all the medical officers on duty at naval air stations, fleet air bases, and on the carriers may be specialists in aviation medicine.

By so doing the Navy will have trained flight surgeons available for the normal rotation of sea and shore duty and also will be ready for any future expansion of naval aviation activities that may require such men with experience. Also by having a large pool of trained men it will be possible from time to time for them to be given details other than with aviation activities if they desire it. All medical officers who are interested in their profession and their career desire and should be given some hospital duty. Flight surgeons should know that their opportunities for such duty will continue after they have specialized in aviation medicine and likewise they should be relieved from duty with aviation activities when they lose interest in flying or when they have been found inapt for such duty.

All medical officers are not suited to be specialists in aviation medicine. Any medical officer can be trained to become an examiner, but a flight surgeon is more than that. The Army Medical Bulletin states that a flight surgeon "must be tactful, sympathetic, tolerant, have initiative, and be well balanced, a good mixer, of unquestionable character and habits. His character and professional attainments must be such as to inspire the confidence and respect of the commanding officer and the flying personnel. Flight surgeons are not made in a day, and as in any specialty, their value increases with their experience in their specialty. He should spend considerable time in the air and should fly with every pilot under his care." It will frequently be necessary in the Navy for a squadron medical officer of a patrol squadron to make long flights with his squadron, and the flying personnel will trust the flight surgeon who flies with them. In no phase of industrial medicine is the medical man so close to the ones for whom he is responsible as the flight surgeon is to the flying personnel with whom he is serving. Such a close association requires "a personality which inclines to human understanding", to use the words of Col. G. I. Jones, United States Army and formerly Chief of the Medical Division, Air Corps, and it behooves the Bureau of Medicine and Surgery to as carefully select its flight surgeons as candidates for flight training are selected.

AN EVALUATION OF A MODIFIED SCHAFER METHOD OF ARTIFICIAL RESPIRATION¹

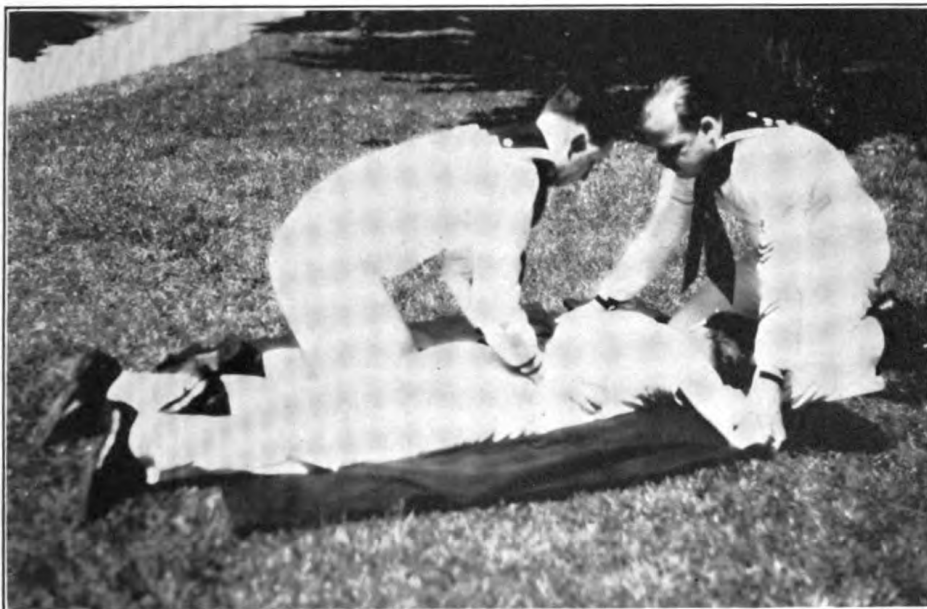
By F. S. JOHNSON, Commander, Medical Corps, United States Navy, J. A. HAWKINS, D. Sc., and O. D. YARBROUGH, Lieutenant, Medical Corps, United States Navy

In 1935 Professor Hederer (1) of the French Naval School at Toulon proposed an improvement in artificial respiration by combining a new inspiratory method with the expiratory movements of Schafer. The original conception of the Hering-Brewer reflex implied that by stimulation of the vagi inspiration was initiated by deflation of the lungs, and that expiration was similarly caused by distension of the lungs. Recently, however, Adrian (2) has shown that the afferent impulses passing up the vagus in normal breathing are purely inhibitory of inspiratory effort. These impulses initiate expiration, therefore, and their disappearance permit inspiration. In the Schafer method of resuscitation inspiration depends entirely on the elasticity of the respiratory muscles and the artificial respiration becomes essentially expiratory in effect. Obviously any simple maneuver offering better ventilation without injury merits consideration. Although the inflation of the lungs by the Sylvester method of artificial respiration is highly desirable, the method is not widely employed because the air passages tend to become obstructed while the patient lies upon his back.

The method proposed by Hederer combines the advantages of the Sylvester method with the preferable posture of the Schafer method. With the patient in the prone position, as shown in figure I, expiratory movements are made as in the Schafer method. An assistant, kneeling at the head of the patient, grasps both elbows and pulls both arms upward, as shown in figure II, as soon as the compression of the lower part of the thorax is completed. This upward movement of the arms is accomplished without changing the position of the hands and head of the patient, and in this manner inspiratory and expiratory movements are imparted to the thorax.

An appraisal of the advantage of the combined method of artificial respiration was undertaken at the Experimental Diving Unit, Navy Yard, Washington, D. C. The respiratory minute volume at S. T. P. (0° C., 760 mm dry) was determined by means of the Douglas bag and gas meter. The tidal air for each respiration was calculated from the minute volume. Taking the Schafer method to represent 100 percent in efficiency, it was found that the applied method averaged about 148 percent efficient. The combined method afforded, therefore, an appreciably greater ventilation. The results in different subjects are shown in table I.

¹ From the laboratory of the Experimental Diving Unit, Department of Construction and Repair, Navy Yard, Washington, D. C.



EXPIRATION.

One assistant exerts pressure over the lower ribs as in the classic Schäfer method.



INSPIRATION.

As soon as the compression of the lower part of the thorax has been completed by the first assistant, the arms are pulled upward and brought together in the median line by the second assistant, in order to imitate normal respiration.

TABLE I

Subjects as indicated by roman numerals	Co of tidal air, with Schafer method, reduced to 0° C. and 760 mm Hg., dry	Co of tidal air, with combined method, reduced to 0° C. and 760 mm Hg., dry	Percent efficiency of combined method compared to Schafer	Subjects as indicated by roman numerals	Co of tidal air, with Schafer method, reduced to 0° C. and 760 mm Hg., dry	Co of tidal air, with combined method, reduced to 0° C. and 760 mm Hg., dry	Percent efficiency of combined method compared to Schafer
I.....	754	1,126	149.3	VI.....	811	1,252	154.3
II.....	858	1,279	149.1	VII.....	711	1,128	158.6
III.....	914	1,392	152.2	VIII.....	827	1,217	147.1
IV.....	914	1,395	152.6	IX.....	835	1,265	151.4
V.....	991	1,427	143.9				

Modifications of the Schafer prone pressure method have been frequently proposed. Investigations of many of these methods have revealed no real advantage. The method introduced by Holger Nielsen (3) has recently received publicity in the daily press. We have not been able to demonstrate that the Holger Nielsen method affords any greater ventilation than the Schafer prone pressure method. In view of the fact that the Schafer method has been standardized by an immense experience, it would be unfortunate to introduce any new details for no real advantage. It is believed that the Schafer method should be continued as the standard when only a single operator is available. On the arrival of an assistant, however, lifting the arms upon release of pressure and lowering the arms when pressure is reapplied should afford a simple means of appreciably increased ventilation.

SUMMARY

1. A combination of the Schafer method and arm lift is evaluated and advocated because of the increased ventilation it affords.
2. The value of the arm lift is emphasized.

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THE USE OF OXYGEN IN THE TREATMENT OF COMPRESSED-AIR ILLNESS¹

By ALBERT R. BEHNKE, Lieutenant, Medical Corps, United States Navy, and LOUIS A. SHAW

The early investigators (Bert, 1878; Zuntz, 1897; and Heller, Mager, and von Schrötter, 1900) concluded largely as a result of theoretical considerations that recompression combined with oxygen inhalation provided a rational and effective treatment for compressed-air illness. Oxygen inhalation, however, has been neglected probably

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for the following reasons: conclusive experimental evidence as to its value was lacking; man's tolerance for oxygen was not known; and facilities were not available for its economic administration. Thus, the treatment for compressed-air illness outlined in the Naval Diving Manual (1924) is essentially recompression with the patient breathing air. While this type of treatment affords relief in mild cases, it often fails in serious cases to prevent disability or death. It seemed worth while, therefore, to evaluate oxygen therapy on an experimental basis, and to determine the limits within which oxygen could be safely inhaled. In this paper are summarized the results of these studies.

The problem.—Rapid decompression after sufficient exposure to increased air pressure may result in the formation of nitrogen bubbles in the blood stream. These bubbles when sufficiently large and numerous mechanically obstruct blood flow, and deprive the tissues of their normal blood supply. Deprivation of blood supply gives rise to the characteristic symptoms of compressed-air illness, namely, asphyxia, paralysis, and pain. These symptoms occur either singly or in combination, and indicate that the areas for bubble formation and predilection are the right side of the heart and pulmonary vascular bed, the spinal cord, and probably the bone marrow. Treatment aims at the removal of bubbles from these areas in the shortest possible time in order to minimize injury particularly with reference to the spinal cord and the right ventricle.

Theoretical considerations.—The routine treatment of compressed-air illness, recompression with the patient breathing air, relieves symptoms immediately by reducing the size of bubbles, but accomplishes little in the way of bubble removal. This will be made clear by an example. If a dog in equilibrium with a gauge pressure of 60 pounds is suddenly decompressed to atmospheric pressure, the dissolved nitrogen in the blood will exist in a state of supersaturation, and diffusion of nitrogen from the blood stream into the lungs will proceed with an initial pressure head of 60 pounds (3,040 mm.). Should bubbles form in the blood, the tension of nitrogen drops rapidly since the pressure in the bubbles is that of the surrounding medium (1 atmosphere) in addition to their surface energy. Since the percentage of nitrogen in a bubble is about

$$82 \frac{(760 - (47(\text{water vapor}) + 45(\text{carbon dioxide tension}))}{760} + 40(\text{oxygen tension}) \cdot 100),$$

and in the alveolar air,

$$75 \frac{(760 - (47(\text{water vapor}) + 40(\text{carbon dioxide tension}))}{760} + 100(\text{oxygen tension}) \cdot 100),$$

nitrogen diffusion proceeds at a pressure head (disregarding surface energy) of about 56 millimeters (7.3 percent .760). Nitrogen from the tissues, meanwhile, is diffusing into the peripheral capillaries at an excess pressure of 60 (—) pounds. Under these conditions the blood stream is rapidly filled with gas in bubble form. By the time that recompression is applied the quantity of nitrogen in bubble form is well in excess of the capacity of the blood to dissolve nitrogen at practicable pressures. Nitrogen in bubble form must be eliminated by passage either into the tissues through the peripheral capillaries, or into the lungs through the pulmonary capillaries. When air (79 percent nitrogen²) is breathed nitrogen diffusion from a bubble (82 percent nitrogen) proceeds with a negligible pressure head.

The futility of eliminating large quantities of nitrogen from bubbles in the pulmonary capillaries when air is breathed, is further emphasized by the results of clinical experience. Thus, Haldane (1927) states that bubble elimination is a slow process, and that it may be necessary to keep a patient in the pressure chamber 24 hours or more. Keays in 1912 reporting on 3,692 cases of compressed-air illness states that recompression, while an efficient means of treatment in mild cases often fails to prevent disability and death in severe ones. In the experiments of Boycott, Damant, and Haldane (1908) bubbles were found in the blood stream of a goat 2 days following decompression, and in the spinal cord 27 days after decompression.

The inhalation of oxygen, on the other hand, reduces the tension of nitrogen in the inspired air to a value approaching zero, and ensures not only a maximum elimination of nitrogen, but also an immediate relief of asphyxia (oxygen lack). At atmospheric pressure oxygen inhalation raises the pressure head for nitrogen diffusion from 7.3 percent to about 80 percent of 1 atmosphere, or an 11-fold increase as compared with air inhalation.

The questions are whether experimental evidence supports these theoretical considerations, and over what range of pressure oxygen breathing is feasible?

Experimental data.—Experiments, heretofore showing the advantage of oxygen inhalation compared with air, have been too few in number to be conclusive. In order to provide more extensive data with reference to the absorption of nitrogen bubbles, 26 experiments were performed on anesthetized dogs decompressed in 10 seconds from a pressure of 65 pounds after an exposure of 1 hour and 45 minutes. The results in detail and their physiologic implications are reported by Behnke and Shaw (1935). For this paper the essential findings, which apply specifically to the problem under discussion, are summarized.

² Includes argon.

The diagram shown in figure 1 represents the procedure in a typical experiment. The 10-second decompression from an excess pressure of 65 pounds led to the development of massive intravascular formation of bubbles in a period of 15 to 60 minutes unless recompression supervened. During period II (fig. 1) bubbles could be detected at the onset of symptoms in cutaneous arteries and veins. Pathognomonic of bubble formation was an increase in respiratory rate, a temporary rise followed by a fall in blood pressure, and a slowing of the pulse rate (fig. 2). Accompanying these symptoms were manifestations of critical arterial anoxemia and a slowing of the circulation. The tongue and mucous membranes and blood withdrawn from the femoral artery were cyanotic. Analysis of the oxygen content of arterial blood showed a reduction from the initial values as high as

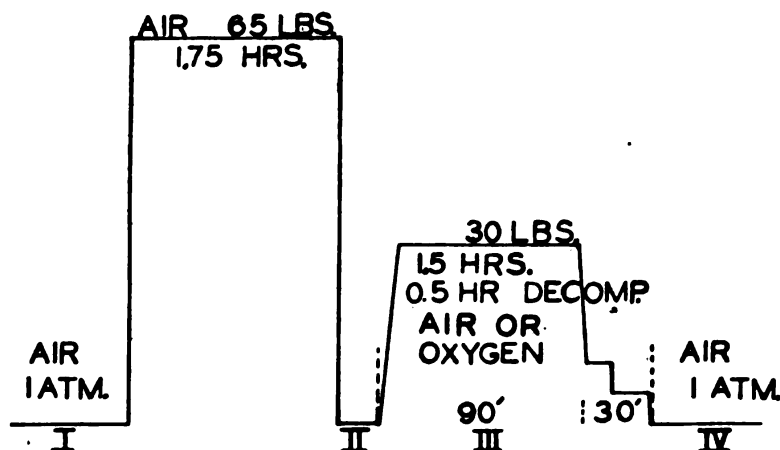


FIGURE 1.—Experimental procedure in the compression and recompression of anesthetized dogs. I, control period; II, asphyxial period following a 10-second decompression from 65 pounds gauge pressure after 1.75 hours exposure; III, recompression to 30 pounds pressure with the dog breathing either oxygen or air; IV, period following recompression, dog breathing air.

66 percent. The reduction of mixed venous blood withdrawn from the right side of the heart was relatively greater, giving a 50 percent or more increase in the arterial-venous oxygen-content difference. The low oxygen content of the venous blood indicated a remarkable slowing of the blood flow through peripheral capillaries. In addition, there was usually a concentration of red blood cells evidently as a result of plasma loss.

The clinical picture was, therefore, acute asphyxia with symptoms indicative of shock. The high degree of oxygen deficit in arterial blood was attributed to the blockage of the pulmonary vascular bed with nitrogen bubbles. These bubbles, presumably, not only interfered with pulmonary ventilation by limiting alveolar expansion but also restricted the circulating blood to comparatively few channels so that the volume of blood flowing through the lungs was diminished in relation to alveolar diffusion surface. Without recompression

death occurred rapidly from respiratory, followed by circulatory, failure, usually with an interval between the two of a few seconds to several minutes.

Recompression to a gage pressure of 30 pounds (fig. 1, period III) with the dog breathing either air or oxygen relieved the asphyxia. Respiratory rate returned to normal, blood pressure was improved, pulse rate increased (fig. 2), and the oxygen content of arterial blood was as high or higher than the initial values. It is important to note that at this stage apparent recovery was as rapid with either air or oxygen inhalation. It is during the period following recompression, however, that striking differences are noted.

One hour following recompression with air (fig. 1, period IV) the asphyxial symptoms (increased respiratory rate, anoxemia) reached

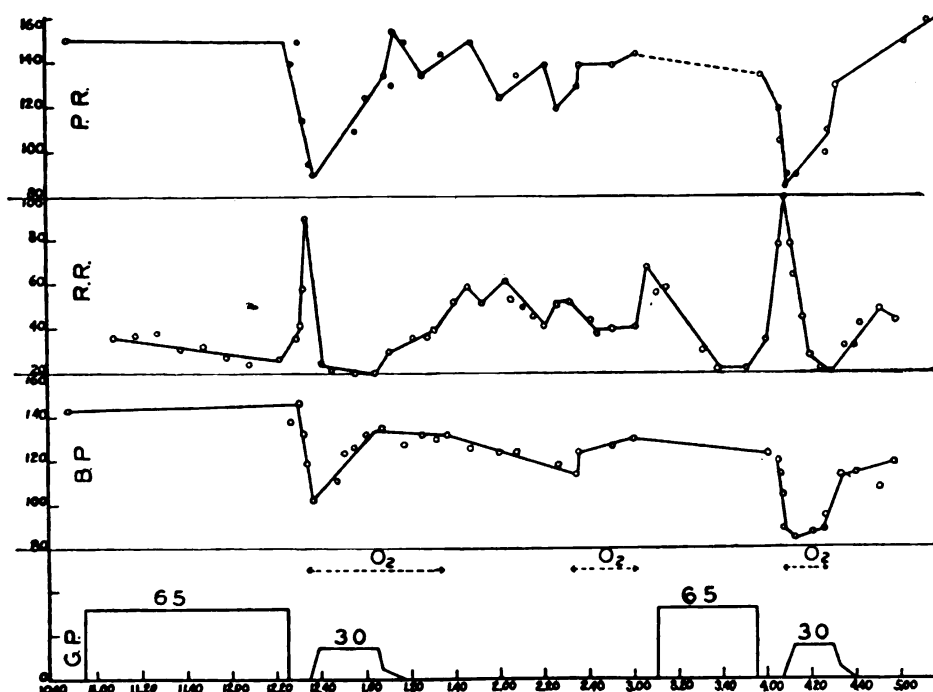


FIGURE 2.—Alterations in blood pressure, respiratory rate, and pulse rate of a dog decompressed in 10 seconds from a gage pressure of 65 pounds after 1.5 hours exposure followed by recompression (interval of 10 minutes) to a pressure of 30 pounds (oxygen) for 25 minutes. Pressure was then lowered to atmospheric in 12 minutes, and oxygen inhalation continued for 17 minutes.

Preceded by a period of oxygen breathing (30 minutes) compression of the dog was again carried out at a pressure of 65 pounds for a period of 45 minutes followed by a 10-second decompression. After an interval of 12 minutes the dog was recompressed to a pressure of 30 pounds for 20 minutes (oxygen inhalation).

their former degree of severity. The low oxygen values were almost the same as those of period II. Bubbles reappeared in cutaneous vessels, and were always present in large quantities in mixed venous blood. At autopsy this finding was verified by the presence of bubble accumulations in the large veins, right side of the heart, and pulmonary arteries. In the peripheral arterial bed bubbles were usually

present in the skin and in the extremities. The greatest amount of gas, however, collected in the venous side of the circulatory system.

In contrast with air recompression the period following oxygen breathing at a pressure of 30 pounds was characterized by a constant or only slight increase in the respiratory rate and by the maintenance of normal values for oxygen saturation of arterial blood. Bubbles when present at autopsy were confined to vessels of the extremities where the blood flow had been at a standstill during the recompression period. While recovery was usually not complete (subnormal blood pressure and circulatory rate) the advantage of oxygen over air was convincingly demonstrated by the permanent relief from asphyxia, and by the complete absorption of nitrogen bubbles from the circulating blood as determined by autopsy examination.

While the experimental evidence shows conclusively the value of oxygen in relieving asphyxia and in promoting bubble absorption it

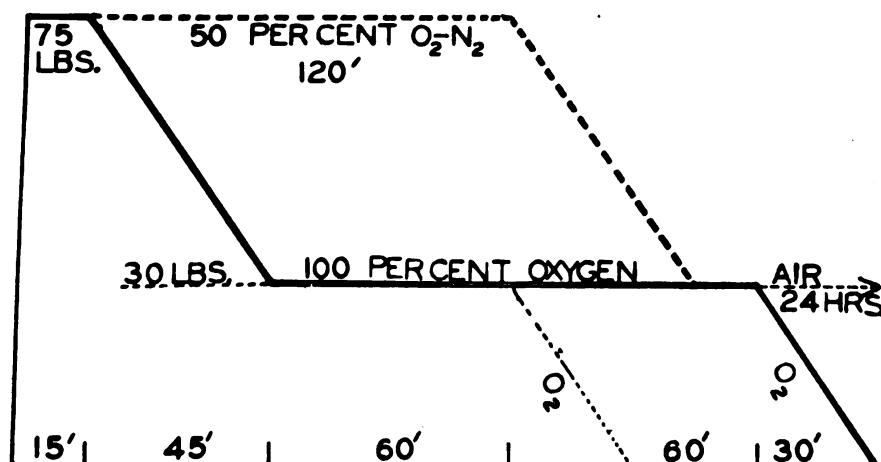


FIGURE 3.—The treatment of a serious case of compressed-air illness with oxygen and an oxygen-nitrogen mixture. Pure oxygen is breathed at or below a pressure of 30 pounds gauge, while the 50 percent oxygen-nitrogen mixture is inhaled between pressures of 30 and 75 pounds. The course of the treatment and the alternatives are clearly outlined.

is essential to determine whether pressures higher than 30 pounds are necessary in recompression. Were asphyxia the only factor to consider, an excess pressure of 30 pounds combined with oxygen inhalation would be sufficient for all cases of compressed-air illness. Whether paralysis could be prevented by a pressure as low as 30 pounds, could not be determined in experiments on the anesthetized dog.

In order to determine the adequacy of a pressure of 30 pounds in preventing paralysis a second series of experiments was performed on intact dogs subjected to the same experimental conditions as were the anesthetized dogs. The results of these experiments are summarized in table 1. Dog 1, for example, was decompressed

from 65 pounds excess pressure in 10 seconds after an exposure of 1 hour and 45 minutes. Three minutes following decompression the dog became excited and showed signs of pain (one of two experiments in which pain was a definite symptom). Four minutes later the dog was recompressed in an oxygen atmosphere to a pressure of 30 pounds for a period of 90 minutes. When the pressure was again lowered to 1 atmosphere (in 1 minute) paralysis of the hind legs was manifest. At autopsy bubbles were not visible in the blood stream. From this experiment it appeared that while bubbles were absorbed, recompression to 30 pounds pressure was insufficient to prevent the development of paralysis. This experiment showed the necessity of reestablishing the blood supply to the spinal cord in the shortest possible time. As a result of several similar experiments (dogs 2, 3, table 1), it was concluded that while the asphyxia was relieved and while the bubbles were absorbed, paralysis could develop during the breathing of oxygen at a pressure of 30 pounds.

In subsequent experiments the treatment was altered by raising the pressure to 65 pounds and then lowering it 5 pounds every 10 minutes until the level of 30 pounds was reached. Air was breathed during this period because a 50-percent oxygen-nitrogen mixture was not available. When the pressure was lowered to 30 pounds the chamber was filled with pure oxygen and the pressure maintained for 1 hour. A 1-minute decompression to atmospheric pressure completed the treatment. With this method of therapy paralysis either did not develop (during the recompression period), or the progress of the paralytic symptoms was stopped (dog 6, table 1). An exception to this statement may be the fact that in dog 5 paralysis of the hind legs developed after 24 hours following an apparently slight injury to the spinal cord.

TABLE 1.—*Treatment of compressed-air illness*

Dog	Date	Exposure	Following decompression (10-second decompression)	Recompression	Results
1	Apr. 23	1.75 hours, 65 pounds.	3 minutes, excitement, pain, outstanding symptom, no paralysis or asphyxia, 7 minutes, recompression.	30 pounds O ₂ for 90 minutes.	Paralysis of hind legs. No bubbles in the blood stream.
2	Apr. 24	1.5 hours, 65 pounds.	No symptoms.	-----	
2	Apr. 29	1.75 hours, 65 pounds.	5 minutes, very active; 8 minutes, heart pounding; 9 minutes, slow heart rate (68); 10 minutes, languid, limping, left foreleg raised from floor; 14 minutes recompression.	30 pounds for 90 minutes (O ₂). After 10 minutes, 30 pounds for 90 minutes (O ₂).	Foot-drop. Dog able to stand but drags hind feet in walking. Unimproved by second recompression. Next day, paralysis and anesthesia of hind legs.
3	May 10	-----do-----	6 minutes, rigidity, left hind leg. Recompression.	30 pounds for 60 minutes (O ₂). After 20 minutes 30 pounds for 60 minutes (O ₂).	Limping; left hind leg rigid. Complete recovery after second recompression.

TABLE 1.—*Treatment of compressed-air illness—Continued*

Dog	Date	Exposure	Following decompression (10-second decompression)	Recompression	Results
3	May 14	1.75 hours, 65 pounds.	9 minutes, limping, left foreleg off floor; 10 minutes recompression.	30 pounds, 60 minutes. After 2 minutes (O ₂), 30 pounds, 60 minutes (O ₂). After 9 minutes, 30 pounds, 60 minutes (O ₂).	Right hind leg flexed. Spastic gait. Weakness hind legs. Spasticity and weakness increased. Autopsy, no bubbles.
4	May 22	-----do-----	4 minutes, collapsed----	65 pounds air-----	Died in 26 minutes under 50 pounds pressure. Autopsy, bubbles in all blood vessels.
5	May 24	-----do-----	5 minutes, left hind leg raised off floor. Recompression.	65 pounds air ¹ 70 minutes; 30 pounds O ₂ , 1 hour.	Recovery.
5	May 28	-----do-----	5 minutes, left foreleg flexed. Recompression.	-----do. ¹ -----	Do.
5	June 11	-----do-----	8 minutes, stretched out, unable to move. Recompression.	-----do. ¹ -----	Do.
5	June 18	-----do-----	12 minutes, no control over hind legs; 13.5 minutes, dyspnea. Recompression.	-----do. ¹ -----	Weakness left hind leg. Ataxia left hind leg. Next day, dog able to walk but developed paralysis (hind legs) on the second day.
6	June 25	-----do-----	24 minutes; limping. Recompressed.	O ₂ 30 pounds, 1 hour.	Recovery.
6	June 26	-----do-----	15 minutes, drags right hind foot; 17 minutes lying on side, hind legs useless.	65 pounds air ¹ , 70 minutes; 30 pounds O ₂ , 1 hour.	Right hind leg ataxic; 2 days later no improvement. 14 days later, recovery.
7	---do---	1.75 hours, 65 pounds.	20 minutes, all extremities drawn up, dog in pain. Recompression.	65 pounds air ¹ , 30 pounds O ₂ , 1 hour, 30 pounds O ₂ , 1 hour.	In good condition for 10 minutes, then vomiting, diarrhea. Active, in good condition.
7	June 28	1.77 hours, 65 pounds.	17 minutes, rigidity hind legs; 18 minutes, hind legs paralyzed, extended, priapism, dyspnea. Recompression.	65 pounds air ¹ , 30 pounds O ₂ , 1 hour.	Spastic paralysis of the hind legs. Reflex arc intact. Autopsy, distended bladder, spinal cord, lungs, normal. No bubbles. Petechial hemorrhages in fat.
8	June 29	-----do-----	27 minutes, cyanosis of mucous membranes and tongue. Left leg raised off floor.	65 pounds air ¹ to 0 gage in 4 hours, 43 minutes.	Weakness, hind legs. Autopsy, a few bubbles in cutaneous vessels.

¹ Air pressure raised to 65 pounds, then lowered to 30 pounds at the rate of 2 minutes per pound; dog then breathed oxygen at 30 pounds pressure for 1 hour.

² Recompression essentially as outlined by the Diving Manual.

From these experiments it can be concluded that whenever bubble formation is massive (i. e., after a 10-second decompression from 65 pounds, 1.75 hours exposure) application of pressure to 65 pounds is necessary to prevent or to arrest the progress of incipient paralysis. While it is extremely doubtful if fully developed paralysis at the time of recompression will improve with the application of pressure, it is imperative in every case to compress the bubbles to a small size, and to secure their rapid absorption or removal from blood vessels in the spinal cord. The application of these findings clinically now depends upon the tolerance of man for oxygen at high pressures.

Tolerance of man for high oxygen pressure.—At atmospheric pressure healthy men can breathe oxygen for a period of 6 hours without symptoms indicative of pulmonary irritation. At higher pressures the effects of oxygen on the nervous system supersede those with reference to the lungs. At a pressure of 3 atmospheres, for example, pure oxygen can be breathed for a period of 4 hours without producing pulmonary injury (Behnke, Forbes, and Motley, 1935). It would appear that insofar as lung damage was concerned there was no direct relationship between the oxygen tension and the duration of exposure. The nervous symptoms, however, bear a direct relationship to the oxygen tension and the duration of exposure. At atmospheric pressure nervous manifestations of a minor character may accompany the breathing of oxygen (Behnke, Johnson, Poppen, and Motley, 1935). At a pressure of 3 atmospheres definite and sometimes apparently alarming symptoms occur during the fourth hour in every experiment. Preceded by a period of normality and with fairly abrupt onset, a rise in blood pressure, increase in pulse rate, and contraction of the visual fields with diminution in visual acuity point to the action of oxygen on the nervous system. Rapid and complete recovery invariably follows when air is again breathed. At a pressure of 4 atmospheres the limit of oxygen breathing is about 45 minutes. At this pressure convulsions or fainting may occur.

The mechanism underlying the action of oxygen on the nervous system is not known, but the significant fact is the reversibility of the nervous phenomena since complete recovery invariably follows the removal of oxygen. In experiments on 12 healthy men subjected (4 or 5 times) to oxygen tensions up to 4 atmospheres residual injury was not detected. While an oxygen tension of 4 atmospheres is to be regarded as a potentially convulsive level and hence to be avoided, a level of 3 atmospheres definitely represents a subconvulsive tension. The fact that pure oxygen at this pressure can be breathed for 3 hours permits oxygen therapy to form an essential part of the treatment for compressed-air illness. It should be remembered that a patient may tolerate oxygen for periods in excess of 3 or 4 hours in view of the probable anoxemia and slowed circulation, symptoms which in dogs were associated with large quantities of bubbles in the blood stream.

Decompression based on oxygen therapy.—The fundamental principle underlying the treatment of compressed-air illness consists in the application of the fact that pure oxygen at a pressure of 30 pounds (3 atmospheres absolute) can be breathed for a period of 3 hours. If pressures higher than 3 atmospheres are used, the partial pressure of oxygen can be maintained at 3 atmospheres by adding air or nitrogen. For convenience, a 50 percent oxygen-nitrogen mixture

could be made available for respiration between 3 and 6 atmospheres absolute. For pressures of 3 atmospheres or less pure oxygen would be breathed.

It is extremely difficult in view of the undetermined quantity of nitrogen in bubble form and of its undetermined distribution in the vascular beds of different organs to draw up a rigid outline of treatment for all cases of compressed-air illness. The condition of the patient, of course, is the criterion for guidance in treatment. The dog experiments (massive bubble formation in the blood stream), however, demonstrate the necessity of using comparatively high pressures (65 pounds) in order to prevent paralysis. These experiments in addition give an approximation of the time necessary for the absorption of bubbles.]

For the serious cases of compressed-air illness in which the previous degree of pressure and duration of exposure, and in which the symptoms (asphyxia, paralysis, loss of consciousness) indicate extensive formation of bubbles, the reapplication of the pressure to 75 pounds with the patient breathing a 50 percent oxygen-nitrogen mixture ensures the immediate relief of asphyxia and the arrest of incipient nerve lesions. The pressure is then maintained at 75 pounds for a minimum period of 15 minutes with the understanding that the time can be extended to 2 hours for the moribund or paralyzed patient.

It may be well to consider what this initial stage in treatment will accomplish. The bubbles of nitrogen according to Boyle's law will be reduced to one-sixth of their volume at atmospheric pressure; as a result of compression the surface area of the bubbles in proportion to their volume is almost doubled, hence diffusion of nitrogen into the surrounding blood will be increased; the capacity of the blood and the tissues to absorb nitrogen will be increased six-fold; and if a 50 percent oxygen-nitrogen mixture is breathed, nitrogen will be eliminated from the body at a pressure head of 3 atmospheres. The quantity of nitrogen eliminated at 75 pounds pressure (with the respiration of a 50 percent oxygen-nitrogen mixture) can be approximately calculated as follows: With a pressure head of 1 atmosphere 35 to 50 cubic centimeters of nitrogen (NTP) are eliminated by a man at rest, weighing 60 kilograms. With a pressure head of 3 atmospheres and a normal circulatory rate a minimum of 105 cubic centimeters (NTP) of nitrogen per minute would be eliminated from the body as long as bubbles maintained nitrogen saturation in the blood stream (large veins and right side of the heart). Under these conditions it would be reasonable to expect the elimination of all or nearly all of the nitrogen in bubble form.

The second and final stage in treatment (patient conscious, respiratory rate normal) following 15 minutes' exposure to 75 pounds pressure, or at least 2 hours' exposure if paralysis is present, consists

in the reduction in pressure to 30 pounds at the rate of 1 pound per minute. At this pressure pure oxygen is substituted for the oxygen-nitrogen mixture. The breathing of pure oxygen for a period of 1 to 2 hours serves to eliminate completely any residual bubbles following the first stage in treatment. This statement is based on the observation that in dogs dying from massive nitrogen bubble formation recompression to a pressure of 65 pounds and decompression in 70 minutes (in air) to 30 pounds pressure followed by 1 hour of oxygen inhalation resulted in the elimination of bubbles visible to the unaided eye. Since the circulatory rate in man is one-half that of the dog, the time for oxygen breathing is doubled (i. e., 2 hours at 30 pounds for the treatment of a previously moribund patient). If the patient is in good condition after 1 hour of oxygen breathing the pressure is lowered to that of the atmosphere over a period of 30 minutes. If, on the other hand, the condition of the patient indicates that bubbles are still present after the completion of oxygen breathing at a pressure of 30 pounds or its equivalent partial pressure for 3 hours, or if the return to atmospheric pressure is attended by increased respiratory rate, difficulty in breathing, and pain, air is substituted for oxygen and a pressure of 30 pounds maintained for 24 hours. At the end of 24 hours the inhalation of oxygen for 2 hours followed by a 30-minute decompression to atmospheric pressure completes the treatment. In figure 3 the therapy is represented in graphic form.

In order to summarize the main points in the treatment of a serious case of compressed-air illness it can be stated that recompression is simplified to two stages and utilizes oxygen breathing. In the first stage the patient breathing a 50-percent oxygen-nitrogen mixture is recompressed to 75 pounds pressure for a minimum period of 15 minutes. Symptomatic recovery and the absorption of all or nearly all of the nitrogen bubbles are the objectives in this procedure. Treatment at a pressure of 75 pounds can be prolonged for 2 hours, if necessary. In the second stage after the pressure has been reduced to 30 pounds, pure oxygen is breathed for a period of 1 to 2 hours. Treatment is completed by decompression in 30 minutes to atmospheric pressure. Unrelieved or partially relieved symptoms require treatment by prolonging the compression at 30 pounds (patient breathing air). At the end of 24 hours oxygen is breathed for 2 hours. Toxic symptoms from oxygen should not occur (contraction of the visual fields, rise in blood pressure and pulse rate) with 3 hours of oxygen breathing in any 24-hour period.

Since 90 percent of the cases of compressed-air illness are mild and exhibit symptoms designated as "bends" (pain in the extremities), recompression to a pressure of 30 pounds with the inhalation of oxygen for 1 hour, followed by a 30-minute decompression, should be sufficient.

Concluding notes.—During the first stage in the recompression treatment the body should be maintained in a horizontal position with the head and shoulders inclined slightly downward. This procedure will protect the blood supply to the brain since bubbles tend to accumulate in the most elevated parts of the body (Van Allen, Hrdina, and Clark, 1929).

The follow-up treatment of the severe cases is designed to protect the heart and to prevent pneumonia. In patients afflicted with spinal cord injury retention of urine and the formation of decubitus ulcers are to be prevented. The concentration of red blood cells (plasma loss) associated with massive bubble formation (dogs) suggests the value of isotonic glucose-saline solution preferably administered subcutaneously, or if intravenously, very slowly (500 cubic centimeters in 30 minutes) and only after the completion of compression treatment.

The facilities for oxygen administration consists of cylinders and a spirometer to which is attached either a helmet or a mask. By adding a soda lime cannister, cooling coil, and blower oxygen can be rebreathed with a minimum loss of gas.

SUMMARY

On the basis of theoretical considerations and experimental evidence oxygen inhalation combined with recompression comprises the essential treatment for compressed-air illness.

Since pure oxygen can be breathed without discomfort by healthy men for 3 hours at a gage pressure of 30 pounds (3 atmospheres absolute), it follows that an equivalent tension (50-percent oxygen-nitrogen mixture) can be breathed at a pressure of 75 pounds (6 atmospheres absolute) for a corresponding period of time. These values for oxygen tolerance make possible the use of oxygen over the whole recompression period.

In the treatment of the severe cases of compressed-air illness (prostration, asphyxia, and paralysis) recompression consists of two stages (fig. 3). During the first stage the pressure is raised to 75 pounds and maintained for a period of 15 minutes to 2 hours. At this pressure a 50-percent oxygen-nitrogen mixture is breathed. The second stage consists in lowering the pressure at the rate of a pound per minute from 75 to 30 pounds gage, and substituting oxygen for the oxygen-nitrogen mixture. Oxygen is breathed at a pressure of 30 pounds for a period of 1 to 2 hours, and treatment is completed by a 30-minute decompression to atmospheric pressure. Unrelieved symptoms require a prolonged stay at 30 pounds pressure for 24 hours and a second period of oxygen inhalation.

In the treatment of mild cases of compressed-air illness ("bends") oxygen inhalation at a pressure of 30 pounds for 1 hour followed by a 30-minute decompression should effect permanent relief.

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PATHOLOGICAL FRACTURES

By FOSTER H. BOWMAN, Lieutenant Commander, Medical Corps, United States Navy, retired

Allen states that spontaneous fractures are not rare, but that published information on their diagnosis and treatment is extremely brief and scanty. The primary cause, or pathological condition, is of great importance, while the immediate cause is usually of little importance.

These fractures are indeed quite common and it is surprising that more has not been written about them.

A good definition of a spontaneous fracture might be "A fracture occurring from apparently insufficient trauma." The bone gives way under apparently trifling stress, because of defective development, constitutional disease, local or general bone disease.

The fractures from incoordinated but powerful muscle contraction, as occur in tabes or syringomyelia, hardly belong to this group. Also in old age it is quite usual to have absorption of bone tissue in both

spongy ends and in the shaft with substitution of fat; this predisposes to fracture, yet no real disease of the bone is present. In trophic lesions, and as the result of long disuse, a condition similar may occur.

In osteogenesis imperfecta, a development defect, and in osteop-sathyrosis, a congenital condition, spontaneous fractures are common, although there is no real bone disease and repair is normal in both conditions.

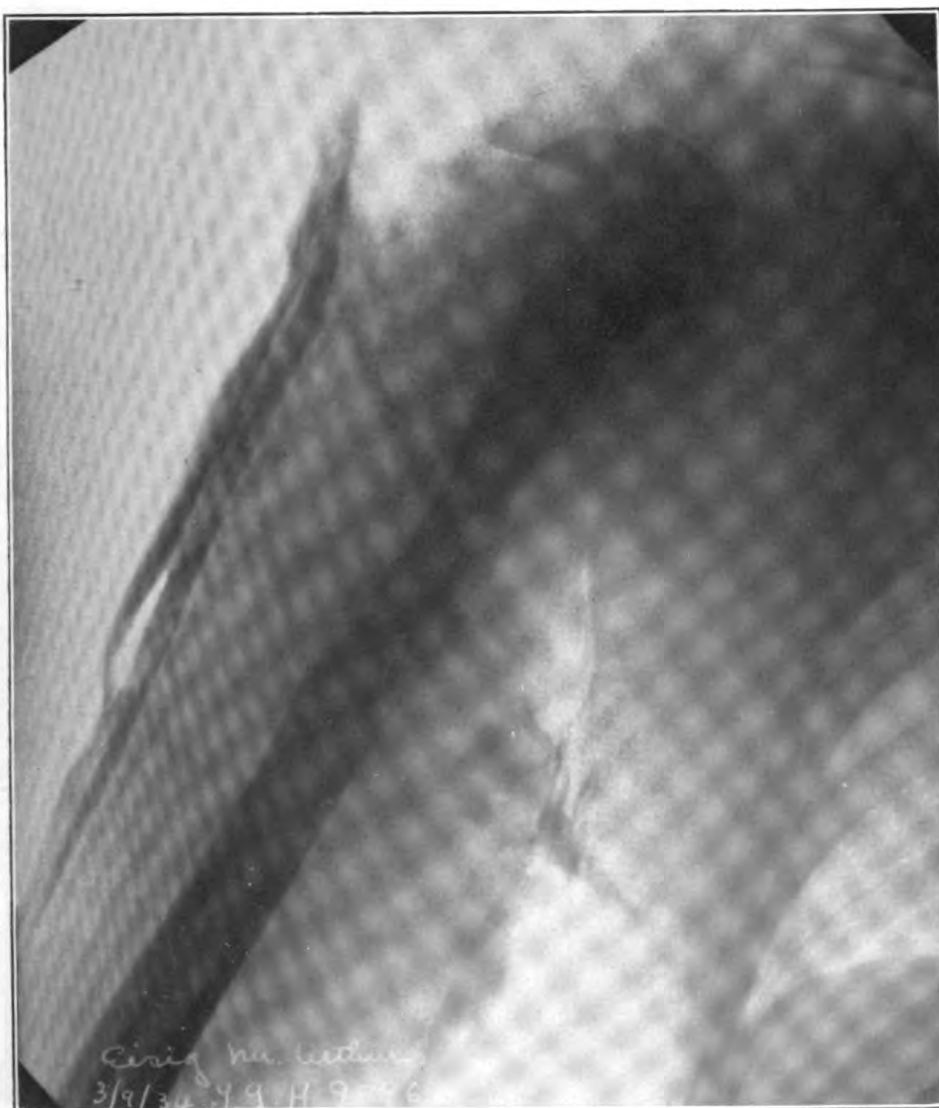
Certain diseases through a state of general malnutrition, favor fractures; such as scurvy, rickets, osteomyelitis, tuberculosis, chronic intestinal diseases, and kidney disease.

Osteomalacia is probably a nutritional imbalance disease. It is seen in epidemic form at times, as in the countries of central Europe at the close of the World War, and is frequent in India and China. The bones become soft. Lime is taken away from them by absorption and a certain attempt is made at repair by tissue which does not ossify. Marked deformity occurs with fracture. The skull shows no change, but the pelvis is compressed and the femurs are bowed and the trunk "telescopes." It occurs mostly in females during pregnancy but also occurs in men and children.

Osteitis deformans, the description which Paget gave this disease, which bears his name, in 1876, has left little to be added to. It is a disease of late middle life, in which the bones undergo change in size and shape and structure. These changes represent a thickening and bowing of the long bones and increase in the thickness of the skull. The change usually involves all the bones. The substantia compacta becomes thinned and of irregular construction, abnormal vascularization takes place, and small cysts appear filled with gelatinous substance. The bones are soft and bend easily. Occurring as it does in late middle life, the diagnosis may easily be confused with metastatic bone tumors of carcinoma in the prostate or thyroid. The bone unites normally after fracture.

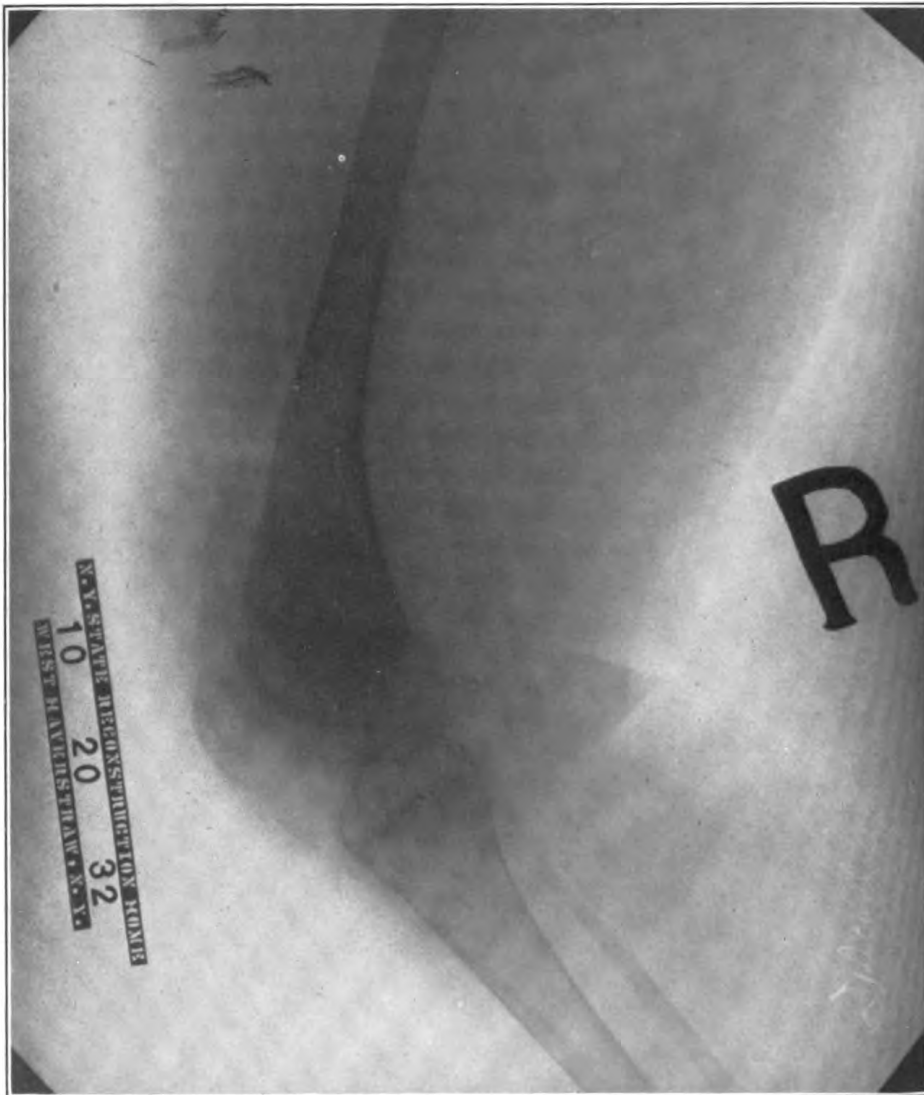
It is among the local conditions that great care must be exercised in making an accurate diagnosis and good judgment used in the treatment. The final outcome, good or disastrous, will depend upon the decision. Among these may be mentioned neoplasms, local osteomyelitis, tubercular or syphilitic processes, and bone cysts.

Cotton says spontaneous fractures deserve especially careful roentgenographic study, for early recognition of a local cause may make clear the problem of corrective treatment, as well as actual repair of the fracture. In making this study it is important that X-ray of the lungs be made for metastases. X-ray pictures of the chest is also a necessary procedure in the following up of malignant bone disease. Multiple metastatic bone lesions may point to the prostate or thyroid as the initial lesion, etc.



OSTEITIS FIBROSA CYSTICA.

Fracture of the humerus; other bones showed cystic disease.



OSTEOGENESIS IMPERFECTA (FRAGILITAS OSSUM).

This patient has had seventeen different fractures. Note the old fracture and atrophy of the cortex.

Local osteomyelitis in the acute condition rarely causes fracture because the disability incident to pain, fever, etc., keeps the patient from any activity which might cause fracture. Also these intense local manifestations together with the X-ray and blood count gives a clue to the diagnosis. In the chronic form the diagnosis is apparent, and the treatment well known.

Gumma, often the cause of fracture, will give the appropriate serological reaction. Homes and Ruggles state that "Irregular areas of destruction may occur in any bone, usually as a result of gummatous changes." In the long bones, gummata are generally associated with periosteal changes. A patient with a bone tumor should always have the benefit of a Wassermann.

In the neuropathological joint disturbances of tabes dorsalis and syringomyelia—Charcot's joints—fracture and dislocation are common. Aside from the large painless joints, the neurological symptoms accompanying the condition are apparent. Treatment is unsatisfactory. Attempts at stabilizing the disintegrating joint by operation, as in bone grafts, etc., have not been followed by success, except possibly in spinal fusion. Support and braces, and the proper neurological treatment, is indicated. Knowing the tendency for fracture and dislocation, every effort should be toward prevention.

Tuberculosis of bone is often quite difficult to diagnose. It usually occurs in children, but so do the various types of bone cysts and sarcoma. The diagnosis of tuberculosis of the bone depends upon many bits of evidence pieced together to make out a case—the history, blood count, tuberculin test, guinea-pig test, microscopic examination of tissue, etc. Wakely has summarized what X-ray shows in diseases of bone and joints as follows:

A uniform thinning of the cortex of the bone; a condensation and broadening of the capsule; destruction of cartilage or thinning of cartilage; lack of or the presence of new bone formation; a bone focus of disease, near the epiphysis; the character and extent of the extension of a diseased area of bone.

Taylor says:

If the X-ray shows a distinct central lesion with definite bone shell, with or without fracture, and no extra-osseous soft part lesion, and if palpation reveals nothing and the patient is under 15 years of age, we can be quite certain that it is not sarcoma or any other malignant tumor. The probability is that it is a bone cyst and the next possibility is a giant-cell tumor, rarely a chondroma and in a few instances tuberculosis.

The order of frequency after 15 years of age is benign giant-cell tumor, bone cyst, sarcoma, chondroma, and myxoma.

Of recent years the condition known as osteitis fibrosa cystica has taken up more space in the medical periodicals than all other types of bone tumors. This condition has a definite etiology and was first described by Von Recklinghausen in 1891 and is called on the con-

tinent Von Recklinghausen's disease. It is now well recognized that oversecretion of the parathyroids causes decalcification of bones, with consequent hypercalcaemia and excessive excretion of calcium in the urine. This same deficiency of calcium oftentimes accompanied by a decrease in the phosphorus in the blood has been noted in simple bone cysts. Therefore, an attempt has been made to couple up the two conditions in some way. However, to date the results have been inconclusive with calcium and phosphorus medication. In osteitis fibrosa a definite tumor of one of the parathyroids can always be demonstrated and its removal cures the condition. These tumors are often difficult to locate because of the unusual locations of the parathyroids. The author saw several specimens in Vienna where the diseased parathyroid was located in the substance of the thyroid gland and was removed with the lobe of the thyroid.

In passing it is to be noted that every enlarged parathyroid does not cause a derangement in the calcium and phosphorus metabolism, as the author has seen two cases in operating on the thyroid where one of the parathyroids was as large as a bean with no symptoms whatever.

The isolated cysts seen in the long bones of young people are the type of bone cysts usually causing spontaneous fracture. Jacoby states that these cysts are of two main groups: (1) The osteomalacias, which include rickets and osteomalacia on the one hand and the so-called osteodystrophies on the other; (2) the benign tumors of the bone which lead to cyst formation.

In the first group the most important disease is the localized form of osteodystrophia fibrosa, formerly called osteitis fibrosa. In the second place of importance are the benign tumors, such as, enchondromas, fibromas, and the so-called brown tumors or benign myelogenous giant-cell tumors which often form cysts.

Joüon states that the most frequent sites of these bone cysts are the femur, tibia, and humerus. The symptoms are usually mild, consisting of slight pain and sometimes moderate swelling. Fracture is frequently the initial symptom. The general condition of the patient is excellent, and the remainder of the skeleton is not affected. The radiographic features permit one to rule out chronic bone abscess, tuberculosis, and syphilis. The most common error is in diagnosing these cysts as sarcoma or giant-cell tumor. He recommends painstaking curettage with or without the use of osteoperiosteal bone fragments.

In the author's experience spontaneous fracture usually heals with the obliteration of the cyst cavity in these cases.

Esau states that rounded, circumscribed areas of lessened density are often observed in bones, usually of the hand, and may in fact represent true cysts. The most usual observed bone cysts are those



METASTATIC CARCINOMA.

Pathological fracture of the shaft of the femur. Primary lesion in breast.



PAGET'S DISEASE.

Fracture of the shaft of the femur. Skull and long bones also showed the same mottled appearance.

of the carpus, which are considered to be dependent upon osteomalacia, the result of repeated trauma. These cysts have little clinical importance except for the likelihood of fracture, and often heal spontaneously. Symmetrical cysts of the carpus have been reported in the literature, and he adds a case with a fracture of his own. He considers the changes here to be trophic. In this connection it is interesting to note that cystic disease of the bones of an extremity which has become paralyzed from poliomyelitis has been observed in patients who have had the latter disease in adult life. It has, however, never been observed in those who have had poliomyelitis in childhood.

Platt reports a series of 20 cysts on 17 patients, and in 13 of which a microscopic examination was made from material obtained at operation. He found eight chondromas (myxochondroma) and five cases of local osteitis fibrosa. He states that the most effective way to eradicate the lesion is to curette the contents and cauterize the interior of the cyst with pure carbolic acid. He also combines this with the insertion of one or more autogenous bone grafts, where the cavity is large.

In all types of simple cyst, it is well to have a blood calcium and phosphorus estimation made. A variation of one or both of these elements is often found. Some reporters have had excellent results in preventing recurrences of cysts by calcium, phosphorus, and parathyroid medication. Others report no value whatsoever in this treatment. Wilson reports one case of simple cyst cured by deep X-ray therapy. (It may be this was a giant-cell tumor with cystic degeneration.)

Giant-cell tumor is a low-grade neoplastic process, usually single, sometimes multiple, affecting usually the epiphysis of the long bones, but may occur in any bone of the body, producing a multicystic excavation with widening of the shaft, and pursuing a prolonged and generally progressive course with no metastases. Its usual termination is death from hemorrhage or infection after the tumor has caused large bone destruction. According to Ewing, the typical giant-cell tumor appears in the epiphysis of a long bone and causes an excavation of the cancellous tissue and a protrusion and thinning of the shaft, while the periosteum long remains intact and lays down new bone as the tumor enlarges. The diagnosis of a giant-cell tumor can usually be made upon the characteristic radiographic signs. They show the location in the epiphysis, a marked widened shaft, preservation of the periosteum, sharp demarcation at the diaphyseal border, a multicystic appearance, and absence of periosteal elevation and other signs of sarcoma.

X-ray treatment of giant-cell tumors is rapidly replacing surgical treatment. In nearly all cases, even in the advanced stages they may, be controlled.

Sarcoma is of two types. Central sarcoma shows a little better prognosis than periosteal sarcoma. The former grows less rapidly. According to Taylor, a myxoma, central or periosteal, should be classed with and treated as sarcoma, because it always recurs. Sarcoma rarely produces fracture.

Ewing states that the—

chief features of the X-ray photograph are roughing of the outer surface of the shaft, and lifting of the periosteum at the advancing edge of the tumor. Very soon there is destruction of the shaft, and a well marked tumor beneath the periosteum. The medullary area usually shows some opacity from growth of tumor tissue within the cavity. Very cellular tumors give mostly destruction of bone, while bone-forming growths cause marked sclerosis of the shaft, obliteration of marrow cavity, and often lines of new bone radiating from the shaft. Central sclerosing tumors show merely increased density of the whole marrow cavity without much periosteal elevation. Vascular tumors are of rapid growth and very destructive, and show no new bone in the radiograph. The common extraperiosteal spindle-cell sarcoma leaves the shaft intact, fails to produce bone, and forms a fusiform tumor displacing the soft parts.

At the Bloodgood clinic for sarcoma of the bone, patients are given preoperative irradiation in all bone lesions which are suspicious of malignant disease, and this preoperative irradiation is carried over a period of 3 months. When they operate, if the lesion is in the upper extremity, it is frequently quite possible to do a resection and later a transplantation of bone. In the lower extremity, amputation gives better functional result than resection with bone transplantation.

The urine should be repeatedly examined for Bence-Jones bodies in all suspicious cases. Their presence indicates malignancy. X-ray of the lungs, skull, pelvis, and long bones should never be omitted in bone tumors as Paget's disease and metastatic carcinoma from the prostate or thyroid may thus be diagnosed.

Chondroma usually are stationary. When they do grow they frequently cause cysts which produce spontaneous fractures. They are then treated as any benign bone cyst.

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OSTEITIS FIBROSA CYSTICA.
Fracture neck of the femur.



CHARCOT'S JOINT.
Fracture neck of the femur.

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CLINICAL NOTES

A CASE FOR DIAGNOSIS

The following case is published because of unusual interest, particularly as respects the diagnosis:

J. E. H., Chief Gunner's Mate, United States Navy, born June 21, 1899.—U. S. S. *Chicago*, December 6, 1935.—Admitted. Diagnosis: Undetermined (Sinusitis, frontal). No. 2122. Not misconduct. Patient reported complaining of a severe frontal headache and a feeling of dizziness. He states this condition developed during the past 48 hours and gives no history of previous attacks. Examination on admission revealed supra-orbital tenderness, some injection of cornea, both eyes, and a temperature of 102° F. All other findings are essentially normal. Blood pressure is 122/80. Patient put to bed and treated symptomatically.

December 9, 1935.—Temperature has subsided but headaches persist. Patient complains of insomnia and of dizziness, appears listless, speech slightly thickened.

December 12, 1935.—No improvement, although patient's temperature remains normal, there is a continuation of all complaints listed above.

December 12, 1935.—Patient is transferred to U. S. S. *Relief* for further observation, diagnosis, and treatment.

U. S. S. *Relief*, December 12, 1935.—Readmitted. Diagnosis: Undetermined (Sinusitis, frontal). No. 2122. Not due to misconduct.

Family history: Father dead, age 30, cause unknown. Mother living and well, age 55. Two brothers and one sister died when children, cause unknown.

Past history: Measles and mumps as child. No injuries or operations. Gonococcus infection, 1920. Denies syphilis.

Present illness: Three weeks ago, patient awoke in morning with cold and headache. Was treated with aspirin, which alleviated headache which would recur. Headache more severe at night. Had temperature when admitted to sick bay on the *Chicago*. Was in sick bay 6 days before being sent to the *Relief*. Vomited on day of admission. No nausea previously.

Physical examination.—Speech somewhat thick and cerebation seems sluggish. Pupils react to light and distance, some conjunctival injection. Nose, throat, and ears negative. Eye grounds normal. X-ray negative, for sinus involvement. Slight pain in neck but no stiffness. Heart and lungs negative. Blood pressure 140/100. Pulse, 85. Abdomen, negative. Genitalia, negative. Extremities, negative. Reflexes: Knee jerks normal.

December 14, 1935.—Vomited during the night. Eye grounds: Some swelling of nerve heads, veins moderately engorged.

December 19, 1935.—Considerable papilloedema both eyes. Spinal puncture with marked increase of intracranial pressure.

December 22, 1935.—Transferred to medical service for observation without change of diagnosis.

December 22, 1935.—Received on medical service. It is noted that since admission patient has started to run a slight elevation of temperature in the evenings, very gradually increasing to the present date, at which time it is 100.4° F., pulse has remained about 80. He complains of headaches and dizziness if he raises up, and sometimes vomiting.

The neurological examination is entirely free from any localizing signs. It is necessary to give codeine for headaches, and bowels are kept in proper condition with salines.

X-ray of skull.—In the various views of the skull there is no evidence of fracture, the accessory sinuses appear clear, and the mastoid cells clear cut and well defined.

1. The blood vessel markings appear normal.
2. There is no increase in the convolutional markings.
3. All the suture lines appear normal except possibly the occipital-parietal sutures.
4. The pineal gland is calcified but is not observed in the A. P. view.
5. The sella tursica appears normal and there is no evidence of erosion of the anterior or posterior clinoid processes.

In view of these findings there can be no roentgenological diagnosis of increased intra-cranial pressure. X-ray sinuses. All the sinuses appear clear. Lumbar puncture was done on December 14, 1935, and again on December 19, 1935; each time the fluid was under considerable pressure. A copy of all the laboratory work in chronological order follows:

December 12, 1935.—Blood count: W. B. C. 16,200; band forms 14%; segmented 54%; lymphs 23%; eosins 5%; basos 3%; monos 1%.

Urine: Amber, acid, sp. gr. 1.030; albumin and sugar negative; few leukocytes.

Blood: Kahn negative.

December 14, 1935.—Cerebrospinal fluid: W. B. C. 300 per cmm; Diff: Lymphs 84%; eosins 9%; basos 2%; monos 5%; Globulin 4 plus. Kahn negative. Colloidal gold 0001232100.

Urine: Amber, acid; sp. gr. 1.027—albumin and sugar negative; some mucus; occasional round epithelium.

Blood chemistry: Blood sugar 107 mgms; urea nitrogen 14 mgms. per 100 cc of whole blood.

December 19, 1935.—Feces: No ova or parasites found; occult blood strongly positive.

Cerebrospinal fluid: Cell count: W. B. C. 1,300 per cmm; Diff: Neutros 1%; eosins 15%; monos 3%; lymphs 81%; Smear: Gram's stain. No organisms found. Acid-fast stain. No A. F. B. found. Chlorides: 676 mgms per 100 cc of spinal fluid. Sugar, 36 mgms per 100 cc of spinal fluid. Colloidal gold 0111232100.

December 20, 1935 Blood count: W. B. C. 15,800; band forms 6%; segmented 47%; lymphs 31%; eosins 9%; basos 1%; monos 8%.

December 31, 1935—Temperature range has been up to 101° F. in the evenings. The W. B. C. has shown a tendency to decline.

Blood count—W. B. C. 11,500; band forms 10%; segmented 55%; lymphs 22%; eosins 5%; basos 2%; monos 6%.

The spinal fluid findings are not clearly indicative of any particular condition, but are strongly suggestive of a tuberculous involvement. Brain abscess, a neoplasm with active inflammatory changes and encephalitis have all been considered, but it is believed not sufficient data are available to establish a diagnosis at this time. In the meantime, an expectant plan of treatment is being followed, with watching of the degree of papilledema present.

† January 6, 1936—Neurological examination: Pupils rather large, equal, regular, limited reaction to light—no ptosis or lagging, no nystagmus or strabismus. Forehead wrinkles normally. No asymmetry of face. Tongue protrudes in midline. There are indefinite rather coarse tremors of tongue. Speech and swallowing good. The deep tendon reflexes are rather active throughout and equal on both sides. No ankle or patella clonus. No tremors. Cutaneous sensation to

sharp and dull point normal throughout. The usual coordination tests satisfactorily performed. Patient is too ill to perform the finer movements with any degree of precision. Cutaneous reflexes readily elicited. No Hoffman. No Babinski. Deep pressure sense acute. Sense of position and vibratory sense intact. There is no pain but there is an inability to extend the leg to a normal degree in the Kernig posture, both sides, and there is a sense of resistance to bending the head forward on the trunk. There are no sphincter disturbances.

January 8, 1936—There is a tendency to less elevation of temperature in the evenings. Papilledema has been only moderate.

January 12, 1936—Highest temperature today 98.8° F. Pulse 76. Respiration 18.

January 14, 1936—Temperature went to 102.2° F. Pulse 90. Respiration 20.

January 15, 1936—Blood count—W. B. C. 11,200; band forms 7%; segmented 63%; lymphs 28%; eosins 1%; monos 1%.

January 16, 1936—Available transportation has been obtained for this patient to a hospital ashore. He is being transferred without a change of diagnosis for the reasons given above.

January 17, 1936—Transferred to United States Naval Hospital, San Diego, Calif., for further observation, treatment, and disposition.

United States Naval Hospital, San Diego, Calif.—January 17, 1936—Readmitted. Diagnosis: Undetermined. (Sinusitis, frontal.) No. 2122. Origin not due to misconduct.

January 17, 1936—Patient received in this ward at 1600. Was having severe chill at time of entry. During this time he would cry out at intervals, but face shows no expression associated with pain. Questioning revealed that when these cries occur, pain in head of sudden stabbing nature appears, and patient says he is always conscious of slight headache between these spells of severe pain. Patient is fairly well-developed male, age 35. He is sick. Is unable to comprehend everything said. His face is expressionless most of the time. Makes no purposeless movements. Can answer questions correctly after several minutes of thinking and repetition of question.

Skin: Is warm, dry, elastic. Pulse is not rapid. Further history unobtainable. (See health record.)

Physical examination—Head: No tenderness. Ears: Hearing grossly normal. Eyes: Negative; pupils round, equal, react to light incompletely, in that they do not contract as far as usually seen. No lid lag. Vision grossly normal. Nose: Dried blood, both nares. Throat: Tonsils swell. Pharynx post nasal blood covers this and unable to see clearly. Tongue coated. Protrudes in mid-line, fine tremor. Forehead: Able to wrinkle skin of this area, evenly both sides. Neck: No glands palpable. Chest: Unable to examine lung posterior as it causes patient pain to move. Heart: Negative. Pulse of good quality, rate 92, BP 136/90. Abdomen: Negative. Lumbar region, right side is tender on deep palpation. Genitalia, no scars. Extremities: Large calluses, soles both feet. Reflexes Unable to obtain either abdominal or Cremasterics. Knee jerks: Active and noticeable small kicking tremor in legs following initial response to stimulus (clonus)? Babinski, not present. Chaddock, not present. In fact there is no reaction to stimulus, soles of feet. Ankle clonus: There is a slight suggestion of this in right side upon initial trial. No patellar clonus.

Pain—Patient seems hypersensitive all over.

Kernig—Pain in back of neck on flexion of neck. There is the barest suggestion of beginning flexion of knees.

Brudzinski—Legs can be extended beyond 90°, but causes severe pain along lateral surfaces of both legs.

Eye grounds—Choked discs. Vessels not tortuous.

Laboratory reports: W. B. C. 15,300; juvenis 1; bands 17; segs 52; lymphs 26; monos 4.

January 18, 1936—Rested fairly well during night. Cisternal puncture this a. m. No increase in pressure as measured by Ayre monometer. Fluid water clear. Cell count, differential, smear and culture; pellicle formation guinea pig inoculation and chemistry for chlorides and sugar, to be run on this fluid.

January 20, 1936—Spinal fluid report: Pellicle formation; 676 chlorides mem. per 100 cc. of fluid, sugar 36 mgm. per 100 cc., W. B. C. 620, 77 lymphs; 23 polys; smear shows no bacteria. The pellicle will be inoculated in guinea pig. Still crying out at intervals, is lethargic and it is difficult to make patient understand.

January 23, 1936—Stuporous, and when moved exhibits marked mental retardation. Negativism is also pronounced, refusing to take food or fluids. During sleep cries out at frequent intervals. Bowels do not move voluntarily. Voids involuntarily.

January 25, 1936—Has refused food and fluid, but today with great urging has taken fluids in amount of 2,000 cc. Does not answer questions, and it is doubtful if he realizes what is asked. Urine: Dark amber, acid, 1.024, positive trace albumin, sugar negative, numerous fine and coarse granular casts, numerous cylindroid, considerable amount mucus, few leucocytes (2-10) hi dry field, few erythrocytes, moderate amount squamous epithelium.

January 26, 1936—Understands questions, and answers after long pauses. Weeps profusely when asked about his family. During day was quiet and more cooperative. Has had no bowel movement. Abdomen soft, and no masses or tenderness present. Tonight complains of severe nonpulsating bilateral temporal pain.

January 27, 1936—Copious bowel movement is result of castor oil, enemas having been previously expelled. Seems more clear mentally, but does not readily answer questions.

January 28, 1936—Fecal and urinary bed soiling. Does not call for service, but is ashamed of his acts. Taking fluids well.

January 30, 1936.—Has definite paralysis of mouth. Left corner is pulled to left, thus exhibiting paralysis of right facial. However, there is no evidence of other paralysis involving muscles of expression. Placed on serious list, and for this purpose diagnosis is changed to "Meningitis, Cerebral", as a message cannot be sent to family while patient is carried as diagnosis undetermined.

January 31, 1936.—Eye ground: Eye grounds negative except for rather marked choked disc.

January 31, 1936 —Encephalogram, 44 cc of fluid, under marked increase in pressure. When stilet first removed fluid spurted about 5'', 38 cc air injected and films taken. W. B. C. 200, polys 81; lymphs 19 (exam. of spinal fluid). Dextrose 75; Cl 675 mgm.

February 1, 1936.—R. B. C. 4,540,000; W. B. C. 10,750; Hgb 80; bands 9; segs 69; lymphs 22. Neurologic examination: Eye grounds—bilateral optic neuritis, probably retro Bulbar type, with a small flame of hemorrhage in right eye at 6 o'clock. Neurology: Pupils mydriatic. React well to accommodation but stiffly to light and consensually. Cranial nerves: Roughly negative except motion of tongue and eyes is limited, probably from lack of effort and concentration of this mental patient. Abdominal and cremasteric reflexes absent. Patellar and Achilles are slightly increased and equal. Babinski negative but is suggestive on the right. A positive Romberg on the right. F. N. poorly done again due to lack of effort rather than pathological incoordination. Sensorium overreacts to stimuli generally which means hyperesthesia. Mentally clouded, irrational, delirious, toxic. At times answers rationally and coherently. Impression: Tuberculous Meningitis.

February 3, 1936.—Has some difficulty extending left forearm and complains of pain when it is extended by examiner. Paralysis of left side of mouth almost disappeared. Is still incoherent. No apparent relief from decompression at any time since cisternal.

February 4, 1936.—Spinal, 25 cc for lab. Clear, slight increase in pressure. W. B. C. 107, polys 56, lymphs 44, no organisms found on direct examination.

February 5, 1936.—Patient examined by O. O. D. and pronounced dead at 6:35 a. m.

The diagnosis and autopsy findings of this case will be found on page 96 in the "Notes and comments section" of this number of the Bulletin. They are not given here as it is hoped that medical men who have read this case history may enjoy exercising their diagnostic talent upon this case and then turn to the appropriate page in "Notes and comments", to find how well or ill *their* diagnosis corresponds with the autopsy findings and final diagnosis.

SARCOMA OF THE SKIN, MALIGNANT GLOMIC TUMORS¹

A CASE REPORT

By ALBERT SOILAND, Commander, Medical Corps, United States Naval Reserve.

The patient P. M. A.—Age 45. Appeared at our institution in December of 1920 with a large flat keratinized and deeply pigmented mole approximately 3 centimeters in diameter. This was quite circular in outline and fixed thoroughly into and under the skin, with an elevation above the skin surface of about 4 millimeters. No photograph was made and no microscopic section. Wassermann reaction negative. Its location was on the upper and inner surface of the right thigh. Clinical diagnosis: Melanotic mole. Treatment consisted of five X-ray exposures with a 4-millimeter aluminum filter during the month which under today's measurement factors would yield approximately a total of 1,000 roentgens. The patient when seen for the last time on February 2, 1921, was discharged with a satisfactory result.

On February 21 of the present year, 1936, the patient returned with a lesion closely resembling the first one, 2½ centimeters in diameter, its upper surface rough and slightly nodular; blue-black in color and elevated. From its sharply cut outline the appearance was much like that of a foreign body successfully grafted into the patient's skin and subcutaneous fascia. A careful examination of the patient's body failed to disclose any other pigmented moles or blemishes. The scar of the original neoplasm in the thigh is soft, smooth, and perfectly white and had remained so since his original treatments 16 years prior. The accompanying photograph no. 1 shows the new lesion. Dr. Lindberg, our pathologist, reports on the section as follows:

"Biopsy of plaque on left shoulder: Neurofibrosarcoma, grade 1, of the peripheral nerves; this is sometimes called Sarcoma Cutis and subepidermal sarcoma of the skin."

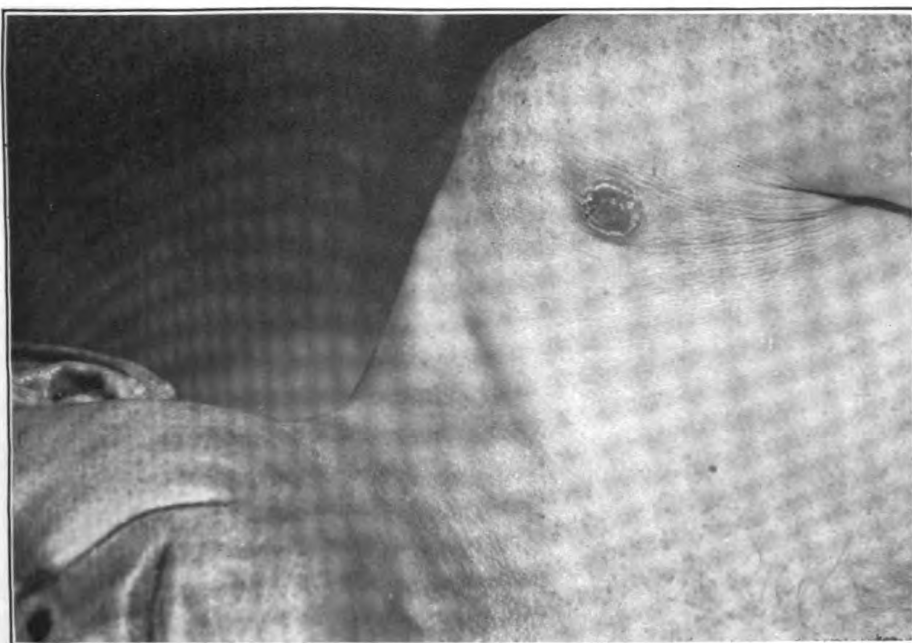
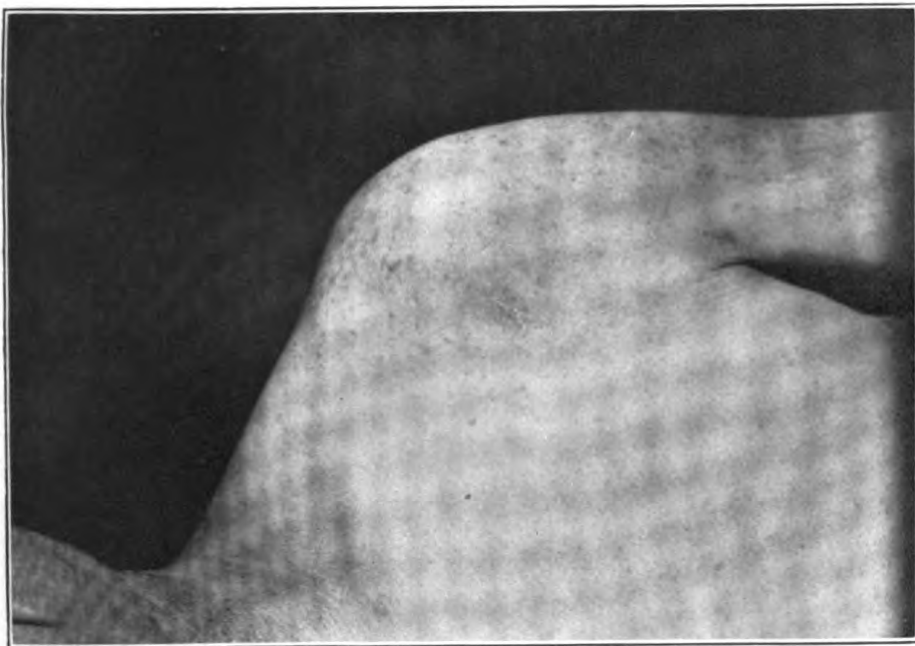
Pathologically, it is a sarcoma cutis or subepidermal sarcoma of the skin and was originally regarded as a neurofibrosarcoma, grade I. Further studies reveal that the tumor is composed chiefly of small, irregular, fibroblastlike cells with round, polygonal, indented, or elongated nuclei. The cells show no collagenous

¹ From the oncological service of Drs. Soiland, Costolow, and Meland, 1407 South Hope St., Los Angeles, Calif.

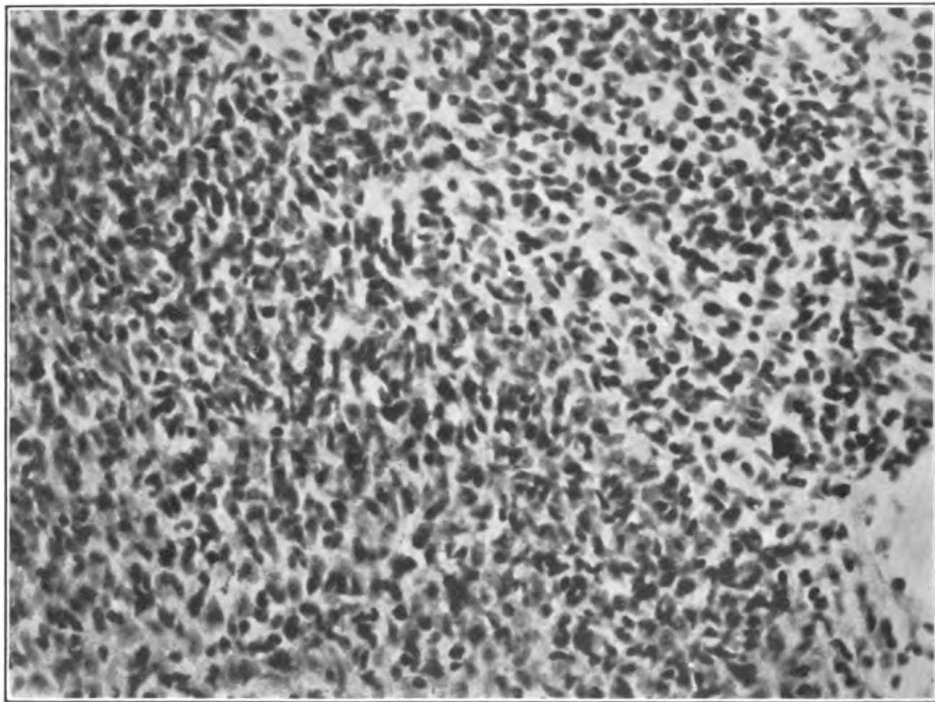
fibrils but some of them are bipolar with a cytoplasm suggestive of smooth muscle cells. Other cells lining ill-formed vascular channels are definitely endothelial, presenting a picture of capillary or "angioblastic" sarcoma. There is marked loss of polarity of the tumor cells, occasional mitotic figures, and occasional large cells with three nuclei. The tumor is circumscribed but not encapsulated. There are bundles of smooth muscle and of collagenous fibers scattered throughout the tumor, and structures simulating nerve fibers. It is concluded that this dermal tumor is a malignant tumor, grade I, of the neuromyo-arterial glomus and not a "sarcoma of the skin." Without studies with the oil immersion lens the cytologic picture is not fully appreciated.

Treatment February 21, 1936. An area of skin over the tumor and twice its size was subjected to 200 r with 100 k.v. 4 ma, $\frac{1}{4}$ mm cu. and 1 mm alum. filters at 30 cm skin distance. On February 28 the mass had been reduced approximately 50 percent in all diameters and to this area 150 r were applied. On March 9 a similar amount was given, the lesion now being flat, contracted, and even with the skin surface. On March 18 the last application of 200 r was ordered, making a total dosage of 700 r, and on April 9 photo no. 2 showed no pathology, a little roentgen tanning still in evidence.

Comments.—Of all the surface lesions we have encountered this is perhaps the most interesting. In the first place the average fibrosarcoma is radioresistant and especially so the nerve type; that endothelial tumors are radiosensitive is well known. The one under discussion, however, proved to be the most radiosensitive tumor we have ever seen or heard of. The patient, now 61 years old, an educated man of good general health, is naturally perturbed over our clinical grouping in his case. He wants to know when the next eruption will occur. In the absence of any glandular disturbance or other demonstrable signs of metastatic connections, our answer is, "in all probability 16 years."



SARCOMA CUTIS.



SARCOMA CUTIS.

NEW DEVICES

A NEW FIRST-AID EMERGENCY OUTFIT FOR DESTROYERS

By

C. B. CAMERER, Captain, Medical Corps, United States Navy

and

H. Z. DUDLEY, Chief Pharmacist's Mate, United States Navy

To insure uniformity and standardization throughout the Destroyers Battle Force, at the same time providing what is believed to be a sufficient and adequate first-aid outfit immediately available for emergency use, the first-aid box and contents herein described have been devised, manufactured, outfitted, and installed in the engineering spaces of all units of this command.

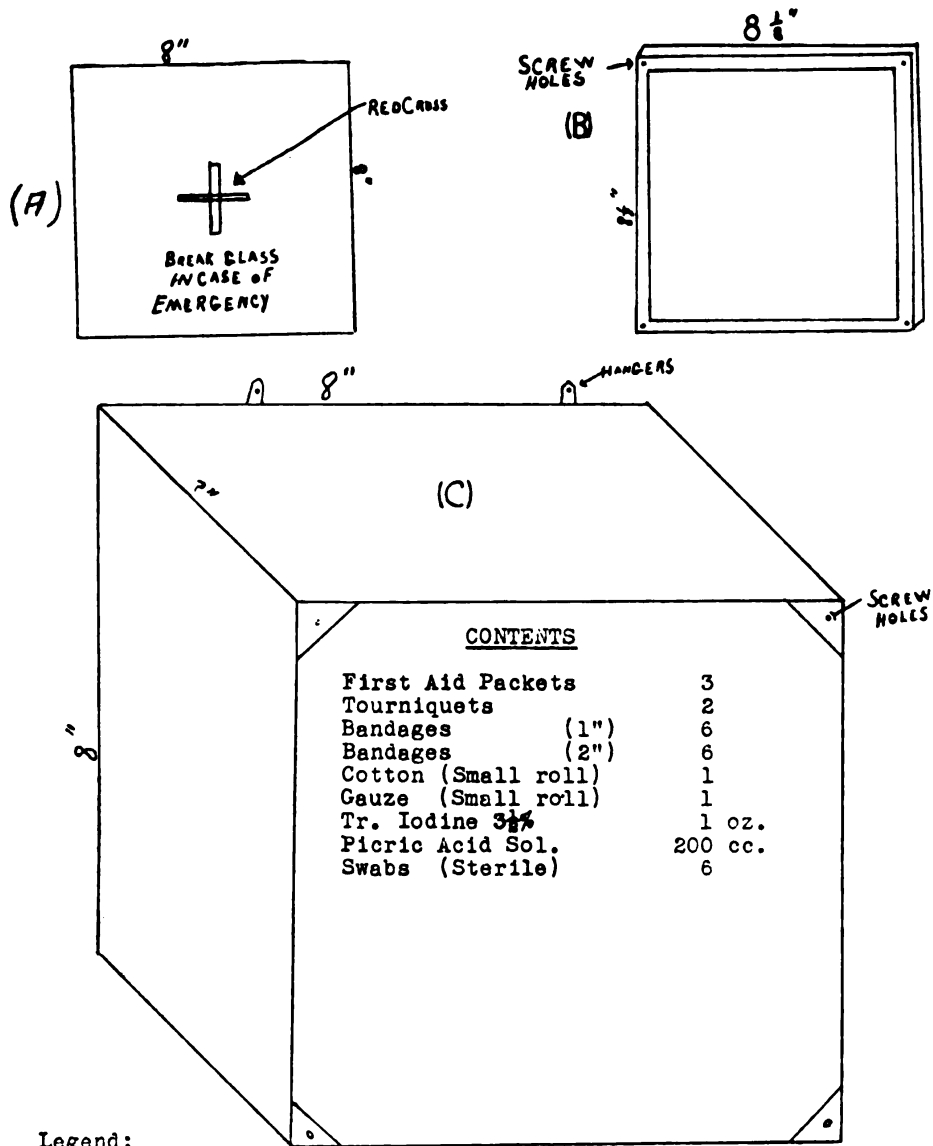
It has been found upon numerous inspections that no satisfactory standard type of emergency first-aid outfit was provided in the engineering spaces of destroyers. Many had none whatever, others had receptacles intended therefor, but long since cleaned out and diverted to other uses, such as tool boxes, cleaning-gear lockers, etc. While some units had more or less satisfactory outfits, but few, if any, had provisions for first-aid treatment in all four engineering spaces.

In view of the foregoing, careful thought was given to a compact, workable, and uniform outfit, standard for all units, containing readily replaceable and available necessary medical supplies stored in a convenient receptacle not readily lending itself to pilferage or other purposes, with a glass front plainly marked for emergency use and, like the time-honored railway tool box and fire alarm, to be "broken in emergency" in order to gain access to the contents.

The sheet-metal boxes were manufactured on board the tenders *Altair* and *Melville* and are rapidly being installed in each engineering space of all destroyers of this force. The contents are supplied by the units themselves and the pharmacist's mate thereof held responsible for their upkeep.

It is recognized that the rubber tourniquets included in this outfit will be subject to more rapid deterioration in the higher temperatures of these spaces than elsewhere; however, this is a matter readily met by routine inspections and replacements as required.

These first-aid boxes have met with most gratifying reception by the personnel as a whole, who feel that real interest in their behalf is

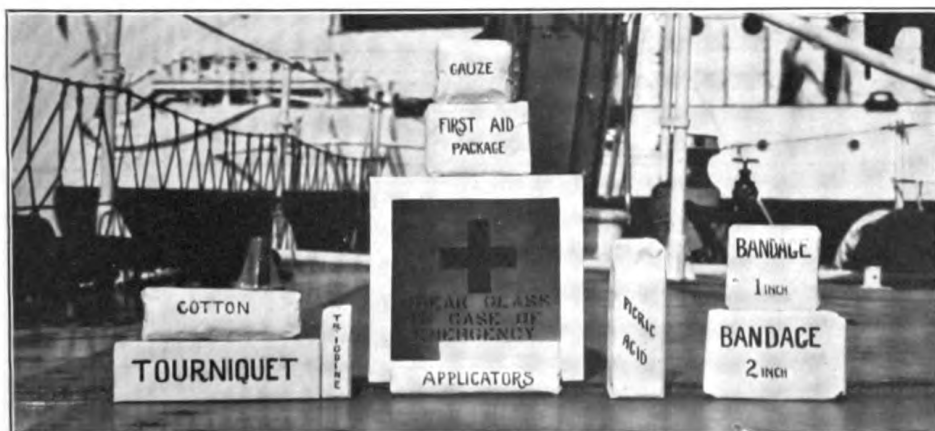


Legend:

- A Glass Front.
- B Frame for Glass Front.
- C Locker. With Contents Listed.

NOTE: Manufacture of 1/16" sheet iron.

shown, thus tending in a small way to the maintenance of morale and contentment, aside from the practical value attending the installation of a standard practical outfit for emergency use.



FIRST AID BOX AND CONTENTS.

NAVAL RESERVE

THE EIGHTH ANNUAL MEDICO-MILITARY SYMPOSIUM

By RICHARD B. PHILLIPS, *Lieutenant, Medical Corps, United States Naval Reserve*

There were 231 officers of the Army and Navy Medical Corps Reserves present at the Mayo Clinic in Rochester, Minn., for the Eighth Annual Medico-Military Symposium held under the auspices of the Mayo Foundation October 4-18, 1936. Of this number, 51 were officers in the United States Naval Reserve; and since this is but the fourth year that Naval Reserve officers have been attending the meetings, we feel that a creditable showing has been made. In 1935 there were 28 Naval Reserve officers present. The course lasts for 2 weeks and during this time the directors of the Mayo Foundation and the physicians and surgeons of the Mayo Clinic place all the facilities of this splendid center at our disposal.

There are two Medical Corps units of the Naval Reserve established at the Mayo Clinic composed entirely of Mayo doctors and fellows. The First Unit, headed by W. McK. Craig, lieutenant commander, Medical Corps, United States Naval Reserve, was commissioned in 1925. Its personnel is as follows:

Lt. Comdr. W. McK. Craig.....	Surgeon.
Lt. Comdr. A. M. Snell.....	Physician.
Lt. Comdr. T. B. Magath.....	Laboratory.
Lt. H. B. Macey.....	Orthopedics.
Lt. L. M. Eaton.....	Neurology.
Lt. H. L. Williams.....	Ear, nose, and throat.
Lt. H. M. Webber.....	Roentgenology.
Lt. Comdr. B. S. Gardner.....	Dentist.

Lincoln Humphreys, lieutenant commander, Medical Corps, United States Navy, who is at present medical officer to the naval recruiting station in Omaha, Nebr., was our chief instructor and administrative officer.

Last year Dr. Humphreys was instrumental in the establishment of the Second Mayo Unit of the Naval Reserve, which is headed by Waltman Walters, lieutenant commander, United States Naval Reserve. The personnel of this unit, which will be completed this year it is hoped, is as follows:

Lt. Comdr. Waltman Walters.....	Surgeon.
Lt. Comdr. J. M. Berkman.....	Physician.
Lt. Comdr. W. L. A. Wellbrock.....	Laboratory.
Lt. Comdr. Virgil Counseller.....	Urology.

After registering on the fourteenth floor of the new clinic building, which, by the way, was only finished 6 years ago, we received our programs for the course. We were addressed by Dr. William J. Mayo, who was a brigadier general in the Army Medical Corps during the war, as was also his brother, Dr. Charles H. Mayo. Dr. "Will", as he is affectionately called in Rochester, is 74 years old and Dr. "Charlie" is 70. Although neither operates now, they both are most active in the work of the clinic and of the Mayo Foundation. We saw a good deal of both of these famous surgeons throughout our course.

Dr. Mayo in his address stressed the importance of having a well-organized Reserve force, and related to us some of the difficulties which they encountered in trying to train 34,000 doctors in the last war most of whom had little or no idea of military medicine. He expressed great pleasure at seeing the symposiums so popular, especially in view of the fact that each officer paid his own expenses in order to attend.

Each day we were presented with programs describing the various operations to be performed on that day, and other notes of medical meetings, speakers, and items of interest to our Reserve group. The average number of major operations per day during our first week was 66.

Every morning we attended one or more operating theaters. Practically all the surgeons were fluent speakers, and they took considerable pains to show us, when it was possible to do so, the various steps in the operation at hand. Nearly all the patients were private, and came from every State in the Union as well as from Mexico, Haiti, Puerto Rico, Argentina, France, India, Spain, and elsewhere. On the first Monday of our course there were 750 registrations in the clinic. The average number of patient registrations throughout the year, per day, is approximately 550. There is a unique subway corridor system for patients leading from the clinic and several of the principal hospitals to and from the main hotels. Each hotel has its own corridor, which allows patients to be wheeled from their rooms directly to any part of the clinic. This labyrinth of underground corridors was but one of many efficient devices which we saw in Rochester. Many of the stairways have ramps, so that one may wheel invalid chairs to various parts without bothering with elevators.

The clinic building itself is certainly one of the very finest structures of its kind in America. It is 15 stories high, with a large tower going up another 10 floors or so. Stone and marble are used in its construction. Each floor is divided into a north and a south wing, with the various departments easily located by means of a fast elevator system. The record room on the ground floor contains about 1,000,000 case histories, and there is a unique carrier apparatus

which conveys the records to any floor without delay. On the third floor are two rooms which are decorated with the foreign and American diplomas, degrees, fellowships, and medals which have been presented to the Mayo brothers. Every visiting medical man should see this wing.

The following officers were in charge of the administration of the eighth symposium:

Commandant and senior instructor---	Col. Kent Nelson, U. S. Army, surgeon, Seventh Corps Area.
Assistant senior instructor-----	Maj. John R. Hall, U. S. Army.
Senior instructor for Naval Reserves--	Lt. Comdr. Lincoln Humphreys, U. S. Navy.
Plans and training officer-----	Lt. Col. Fred. L. Smith, Medical Reserve, U. S. Army.
Adjutant-----	Lt. (Jr. Gr.) W. H. Haines, Medical Corps, U. S. Naval Reserve.

Naturally a considerable part of the work was presented by Army officers, but there was always much of interest in their lectures for the Naval Reserve men. For instance, Col. J. W. Grissinger's talk on Medical Field Service was worth coming all the way to hear. Colonel Grissinger is surgeon to the Second Corps Area, and he spent considerable time at the front, and with the Army of Occupation in Germany. His observations on wartime medicine and surgery and upon the health of 300,000 officers and men with the Army of Occupation were exceedingly interesting.

There were lectures every afternoon and evening in Plummer Hall, on the fourteenth floor of the clinic. Dr. Leo Strassmann, of Germany, who is at present a fellow of the Mayo Foundation, gave us a talk on State Medicine on October 6.

Comdr. Joel White, United States Navy, who is stationed at the new Philadelphia Naval Hospital, spoke to us on Carbon-Monoxide Poisoning. He flew from Philadelphia to Rochester, piloted by Commander Connell.

Dr. J. C. Masson lectured on Living Sutures in Hernia Repair. Dr. Masson is chief of staff of the Mayo Clinic. He described an instrument which he has devised for removing a 10-inch piece of fascia lata through an incision only 1½ inches long. He stated that there was little or no danger of muscle hernia following this procedure, and if it did occur there was no disability.

Lt. Comdr. Lincoln Humphreys gave us an illustrated talk on Sea Sickness which aroused considerable interest and comment. Later in the course he spoke on Making Men-of-Warsmen, also illustrated with movies.

Lt. (Jr. Gr.) A. W. Eaton presented a paper on Submarine-Escape Accidents in Training. Dr. Eaton is in the Regular Navy and is at

present studying at the Mayo Foundation. Other officers of the Regular Navy who are studying at the clinic for from 3 to 9 months are Lt. Comdr. C. M. Shaar, Lt. (Jr. Gr.) J. L. Zundell, Lt. F. L. Read, and Lieutenant Commander Lhamon, all of the United States Navy.

Lt. Comdr. Waltman Walters, Medical Corps, United States Naval Reserve, expressed his results with Surgical Aspects of Lesions of the Biliary Tract. Dr. Walters is chief of the first Mayo Unit of the Naval Reserve.

Dr. Donald Balfour, president of the American College of Surgeons and assistant director of the Mayo Foundation, spoke on The Surgical Management of Complications of the Stomach and Duodenum. Dr. Balfour, together with Dr. Hugh Cabot and the Mayo brothers, is consultant in surgery to the clinic.

The Honorable Melvin J. Maas, Congressman from Minnesota and lieutenant colonel in the Marine Aviation Reserve Corps, talked on The Marine Corps and Its Mission. He is a most dynamic individual and an ardent advocate of preparedness. He is in command of the Marine Reserve air base in Minneapolis.

The symposium was honored by the presence of all three surgeons general—the heads of the Army, Navy, and Public Health Service.

Dr. Parran, Surgeon General of the Public Health Service, gave us a most interesting talk on syphilis and stressed the importance of notification. In Sweden, he pointed out, where notification is compulsory, there were only about 250 new cases last year. Some readers will no doubt remember his splendid article on syphilis which appeared in a recent issue of the Readers' Digest.

Dr. Paul O'Leary presented a most fluent paper on syphilis, in which he described the activities of the Public Health Service and certain large clinics which have been working together for some years in an effort to evaluate the various methods for the treatment of this disease. His conclusions were that a little treatment administered faithfully and regularly over a given time is much better than more treatment administered at irregular intervals and in varying doses.

Rear Admiral Percival S. Rossiter, United States Navy, and Surgeon General of the Navy, addressed us on Peacetime Activities of the Navy. Maj. Gen. Charles R. Reynolds, United States Army, Surgeon General of the Army, spoke on the Reserve force.

Rear Admiral C. S. Butler, United States Navy, presented a most interesting paper on yaws. He is of the opinion that syphilis and yaws are one and the same disease, the atypical clinical course of yaws being due to its tropical distribution.

Capt. George W. Calver, United States Navy, who is physician to Congress, spoke on The Man Past the Forties. Dr. Calver was present during the entire session.

Dr. Hugh Cabot, consultant in surgery to the Mayo Clinic, told us about the recent urological meetings in London and Vienna. He believed that while the urologists in Europe are most competent, they do not specialize on one subject as do so many of our best men. Dr. J. H. Means, who is Jackson professor of clinical medicine at Harvard Medical School, gave a foundation lecture entitled "The Pathogenesis of Thyrotoxicosis." Mr. A. H. MacIndoe, Fellow of the Royal College of Surgeons, of London, and formerly a fellow of the Mayo Foundation, described the English view on plastic surgery. Dr. Figi, of the Mayo Clinic, later spoke on this same subject and presented an extraordinary series of photographs showing some amazing before-and-after results.

Dr. A. W. Adson, of the clinic, assisted by Dr. E. V. Allen and Dr. W. McK. Craig, presented their work on the surgical treatment of hypertension. Three patients who had been operated upon according to the Adson technique were in the room, all of whom had had high blood pressure for some years, plus persistent headache and inability to attend to their work. The operation consists of removal of half of each adrenal gland, the coeliac ganglion and first and second lumbar ganglia with rami communicantes. All three patients appeared to be in the pink of condition, and one, a lady of 34, now plays golf several times weekly. A number of us watched Dr. Adson perform this operation the following morning. The main requirement, says Dr. Adson, is that the patient's blood vessels be free from pathology which might prevent dilation. Thus most of the patients are between 30 and 40.

The Medical Department of a Battleship was the title of a paper by Lt. (Jr. Gr.) J. L. Zundell, United States Navy, and his talk gave many of the men who had never been at sea on actual duty an excellent idea of medicine aboard ship.

Lt. Comdr. E. H. Bruening, of the Dental Corps Reserve, spoke on Disqualifying Dental Defects. Dr. Bruening is chairman of the committee on economics of the American Dental Association and lives in Omaha, Nebr. He is head of the department of anatomy in Creighton Dental School.

A Lister-bag water-purification demonstration was put on at a local C. C. C. camp by Maj. John R. Hall, United States Army. Our entire group was taken out to the camp and we inspected the galley, hospital, and sanitary arrangements. After our tour we were served steaks and a most excellent dinner in the mess hall.

Lt. Col. Frederick L. Smith, Medical Reserve, United States Army, conducted a number of clinics on varicose veins, and our men picked up a number of fine points from Dr. Smith's long experience and excellent demonstrations. One of the men whom he demonstrated and injected was an Army major with our Reserve group.

Lt. Comdr. T. B. Magath discussed Hydatid Disease in North America. Dr. Magath is in charge of the laboratory division of the First Mayo Naval Reserve Unit. Maj. John R. Hall showed moving pictures and gave us a talk on the Panama Canal.

On the last night of the session a banquet was held at the Hotel Kahler, at which 110 Reserve officers, both Army and Navy, were present. Admiral Rossiter, Major General Reynolds, Dr. William J. Mayo, Col. Louis B. Wilson, Col. Kent Nelson, Lieutenant Commander Humphreys, Major Hall, and Lieutenant Colonel Engler addressed the assembled doctors. Col. Louis B. Wilson is, of course, the director of the Mayo Foundation, and Lieutenant Colonel Engler is president of the Reserve Officers Association of the United States.

A resolution was passed extending our thanks to the Mayo Foundation and the Mayo Clinic for having placed their facilities at our disposal.

MEDICAL CORPS

PROMOTIONS, THIRD QUARTER, 1936

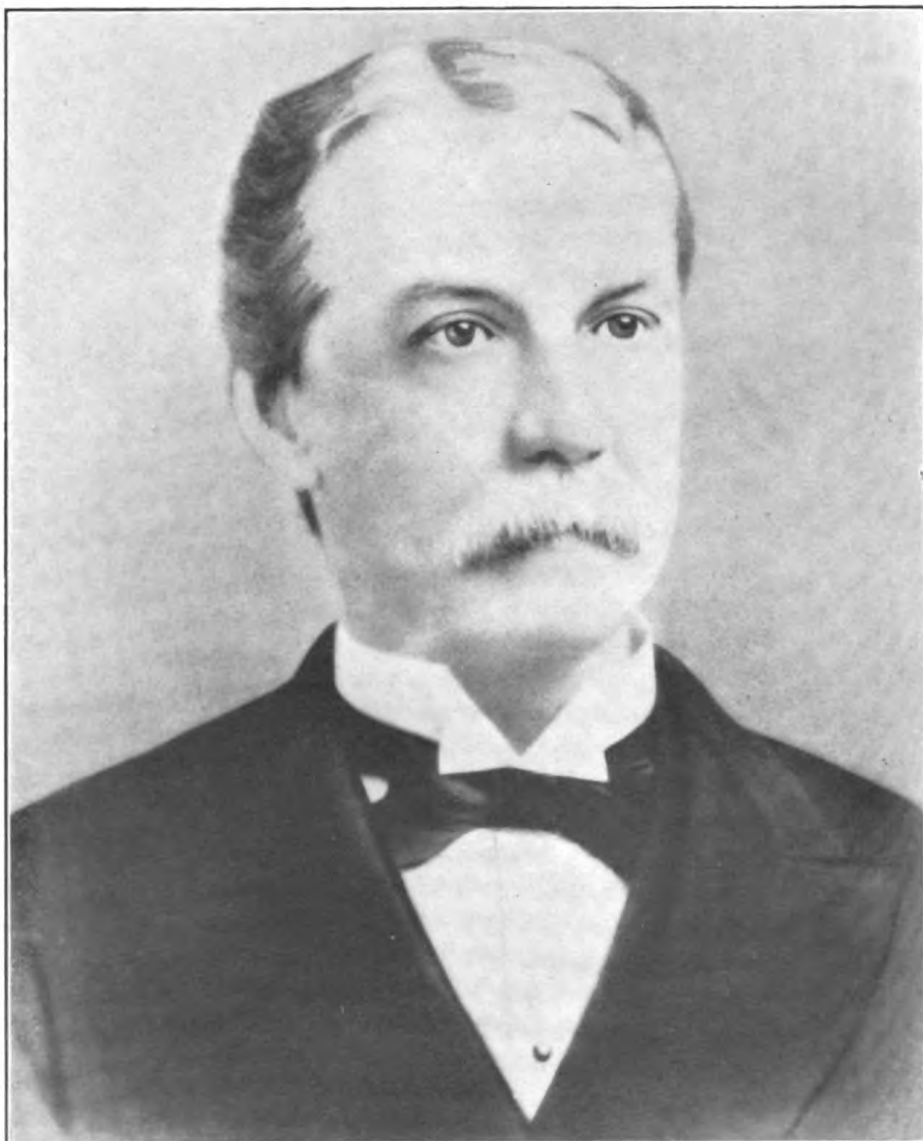
Capt. Porter Bruce Brockway, M. C.-V. (S) U. S. N. R. Promoted from commander M. C.-V. (S), Aug. 12, 1936.

Commander Albert Soiland, M. C.-V. (S), U. S. N. R. Promoted from lieutenant commander M. C.-V. (S), Aug. 1, 1936.

¹ *Commander James Joseph Hogan, M. C.-V. (S), U. S. N. R. Promoted from lieutenant commander M. C.-V. (S), Aug. 5, 1936.*

Lieut. Alfred Myron Glickman, M. C.-V. (G), U. S. N. R. Promoted from lieutenant (jr. gr.), Aug. 12, 1936.

¹ NOTE.—Commander James Joseph Hogan, M. C.-V. (S), U. S. N. R., was placed on the honorary retired list of the U. S. Naval Reserve without pay or allowances, effective Aug. 1, 1936, by reason of having reached the age of 64 years. Retired with the rank of commander, M. C.-V. (S), U. S. N. R.



FRANCIS M. GUNNELL
SURGEON GENERAL, UNITED STATES NAVY, 1884-88.

NOTES AND COMMENTS

FRANCIS M. GUNNELL

SURGEON GENERAL, UNITED STATES NAVY, 1884-88

The twelfth to hold the office of Chief of the Bureau of Medicine and Surgery and the eighth to be Surgeon General of the Navy, Francis M. Gunnell was born in the Federal District on November 27, 1827. He was appointed from the District of Columbia on March 29, 1849, as an assistant surgeon. His first service was in the Pacific Squadron when for a time (in 1853) he was on the storeship *Supply*, when Commander David Farragut, in command, was establishing the navy yard at Mare Island, Calif. He was on board the steam sloop *Fulton* when that vessel was wrecked in 1859. During the Civil War he saw service in the North and South Atlantic Blockading Squadron and the Naval Hospital, Washington. He was commissioned surgeon on April 23, 1861. After the war he served in the European Squadron and at the Naval Hospital, Washington. Commissioned medical inspector in 1871 and medical director in 1875. His later services included duty as fleet surgeon of the North Atlantic Fleet, fleet surgeon of the Asiatic Squadron, and duty at the Naval Hospital, Washington, D. C. He was appointed Chief of the Bureau of Medicine and Surgery on April 1, 1884, by President Chester A. Arthur, serving until April 1, 1888. His assistant chief of bureau was Surg. W. K. Van Reyepen, afterwards Surgeon General.

In this Surgeon General's regime, the naval hospital at Widows Island, Maine, was built to accommodate yellow fever patients returned from the West Indies and Panama. This hospital was placed in commission in 1887, and maintained until 1903. When the need for it had passed, it was transferred to the State of Maine. It is said that the somewhat sinister title of the island did not endear it to the sick sent there.

Surgeon General Gunnell retired from active duty on November 27, 1889. However, he performed special duty in the Bureau of Medicine and Surgery from December 6, 1902 to March 31, 1903, and was president of a medical examining board on September 2, 1903, and again ordered as president of the board from September 25, 1903, and served until September 10, 1907. As he was born in 1827, he thus served as president of the examining board when nearly 80 years of age.

He resided in Washington after his retirement and died at his residence, 600 Twentieth Street NW., on June 10, 1922, at the age of 94½ years. Dr. Gunnell was somewhat above middle height and rather slender. His manner was pleasant and affable. He was always very erect in his carriage even in advanced years.

MEDICAL OFFICERS RECOMMENDED FOR FELLOWSHIP IN THE AMERICAN COLLEGE OF SURGEONS AND THE AMERICAN COLLEGE OF PHYSICIANS

The postgraduate board having passed on the credentials of applicants for fellowships in the American College of Surgeons and the American College of Physicians, the Surgeon General has approved the nomination of the following medical officers of the Navy recommended for fellowships:

IN THE AMERICAN COLLEGE OF SURGEONS

Lieut. Ocie B. Morrison, Jr., Medical Corps, United States Navy.

IN THE AMERICAN COLLEGE OF PHYSICIANS

Commander Daniel Hunt, Medical Corps, United States Navy.

Commander Jesse B. Helm, Medical Corps, United States Navy.

Commander Clarence W. Ross, Medical Corps, United States Navy.

Commander Paul W. Wilson, Medical Corps, United States Navy.

Commander Harold E. Ragle, Medical Corps, United States Navy.

Commander Harold H. Montgomery, Medical Corps, United States Navy.

Commander William H. H. Turville, Medical Corps, United States Navy.

Lt. Comdr. Robert E. Duncan, Medical Corps, United States Navy.

Lt. Comdr. Robert F. Sledge, Medical Corps, United States Navy.

Lt. Comdr. Lloyd R. Newhouser, Medical Corps, United States Navy.

ASSOCIATESHIP

Lieut. Irwin L. V. Norman, Medical Corps, United States Navy.

A CASE FOR DIAGNOSIS

On page 81 of this number of the bulletin, in the section devoted to Clinical Notes, there is given the history of an interesting clinical case. The diagnosis was not given at the end of the case so that the reader might make a diagnosis of his own, and then turn to this page to compare it with the final diagnosis and autopsy findings. These are given below:

On basis of laboratory findings following autopsy, diagnosis coccidiosis (*coccidioides immitis*), no. 2206. Not misconduct. In line of duty. Established.

Autopsy findings: (1) Blood and lymphatic stream dissemination of fungus, *coccidioides immitis*; (2) Cerebrospinal meningitis; (3) Metastatic formation of granulomatous foci in solid viscera, grossly detectable in spleen and liver; (4) Broncho and hypostatic pneumonia; (5) Hypertrophy of heart, moderate; (6) Arteriosclerosis, generalized, early; (7) Parenchymatous changes in viscera of acute and subacute nature.

THE CONTROL OF SYPHILIS AND GONORRHOEA IN SCANDINAVIA AND GREAT BRITAIN

Since 1920 there has been such a marked decline in syphilis in the three Scandinavian countries, and to a somewhat lesser extent in Great Britain, that it has attracted the attention of public health specialists in nearly all other countries. The incidence of syphilis has been so reduced in the Scandinavian countries that it has become almost a rare disease; the only place in the civilized world, certainly, where this is the case.

Naturally the methods by which this desirable change has been brought about have been watched with interest by public hygienists everywhere, and led to the appointment of a commission in New York City to study and report upon the methods employed in the Scandinavian countries and in Great Britain for the control of venereal diseases. This commission included several distinguished members of the medical profession. They visited the countries concerned and made a careful study of the methods employed in the control of syphilis and gonorrhoea and have now published a most interesting report upon the subject. This report appears in print as part II of the American Journal of Syphilis, Gonorrhoea, and Venereal Diseases for July 1936. The commission was principally concerned with discovering the reasons for the marked decline in the venereal rate, having in mind also the possibility of similar methods being utilized elsewhere. In a general way the report gives the following reasons for the lessened prevalence of syphilis:

1. The control of venereal diseases in these countries is considered as a public responsibility and in the Scandinavian countries legal control over the patient is exercised.
2. Free clinical and hospital services by competent and well-paid public physicians are available to any who apply for them.
3. Relationship between the medical profession and the public health authorities, all of whom are well trained physicians, is very close.
4. Laboratory facilities for the serological diagnosis of syphilis are adequate. The State Serum Institute in Denmark serves the whole country and is an outstanding institution of this character.

5. Among miscellaneous features are a homogeneous population with high respect for law; an almost total absence of illiteracy; the limitation of the healing art to the regularly licensed physician; and social legislation supplementary to the public health and medical laws.

There has not been, in these countries, proportionate reduction in gonorrhoea. While the incidence of this disease has been lowered the decline has been far less than is the case with syphilis. The reason for this appears to be that the reduction of syphilis is due principally to stringent medical measures aimed at the diagnosis and treatment of all cases and that the same rigorous means are not applied to cases of gonorrhoea. Chemical or medical prophylaxis is not officially encouraged. In none of the countries is there any regulation of prostitution. In the Scandinavian countries, however, repressive measures of considerable severity against commercial prostitution is carried out with a degree of success.

OLIVE OIL AS AN ANTIDOTE IN PHENOL POISONING

As a result of their work done on animals, Goodman and Geiger believe that olive oil is the best antidote for use in poisoning by carbolic acid. They advise that it be given in as large amounts as possible by having the patient drink it. They then advocate the passing of a stomach tube and lavage with olive oil, a quantity of fresh oil being left in the stomach. Other measures, such as treatment of shock, administration of adequate fluid by parenteral methods, blood transfusion, and relief of pain, are not to be neglected. The authors feel that alcohol, the usual antidote, is unsatisfactory. They experimented with mineral oil and castor oil, both of which they rejected. Castor oil caused an increase in mortality.

When olive oil was administered by mouth 30 of the experimental animals recovered. When gastric lavage was combined with it, as recommended above, the recovery rate rose from 80 to 100 percent.

ISOELIXIR OF THE NATIONAL FORMULARY, SIXTH EDITION

The new National Formulary, with the new United States Pharmacopoeia, contains among other important changes and additions a number of new vehicles. One of the most interesting of these is the elixir isoalcoholicum or isoalcoholic elixir. This vehicle is made in two parts, a low alcoholic elixir containing 100 cubic centimeters of alcohol in a thousand, and a high alcoholic elixir containing 800 cubic centimeters of alcohol per thousand. By mixing varying volumes of these two, any alcoholic strength of vehicle may be obtained. At present if a physician prescribes a tincture, say tincture

of digitalis or a fluid extract such as fluid extract of ergot, he must have the right alcoholic content in any vehicle used with it or a portion of the drug may be precipitated out. Furthermore, the precipitate may be poisonous. With the new isoelixir this is prevented as the pharmacist mixes the low and high alcoholic elixir so as to produce a vehicle of the same alcoholic strength as the tincture or elixir prescribed. For liquid galenicals, therefore, the isoelixir is used in the same strength as the menstrum or solvent used in dissolving the galenical.

When several galenical drugs of different alcoholic strengths are used, the isoelixir is employed equal to what is roughly the average alcoholic strength of the several ingredients.

For nongalenicals the lowest alcoholic strength of isoalcoholic elixir that will yield a perfect solution is employed. In other words, the best solvent is the best vehicle.

The addition of this vehicle makes it easy now for the pharmacist to avoid many incompatibilities.

THE DETECTION OF LEAD IN BODY FLUIDS

The use of the spectroscope has permitted the detection of lead in extremely minute quantities in the body fluids and has made possible the preclinical diagnosis of plumbism. Blumberg and Scott in the Johns Hopkins Bulletin have described the method and given the amounts of lead in the blood in health and varying degrees of lead poisoning. Their figures for the latter are as follows:

.005–0.1 milligram of lead per cubic centimeter—clinically negative.

0.1–0.2 milligram of lead per cubic centimeter—borderline.

0.2–1.0 milligram of lead per cubic centimeter—clinically positive.

Most of their clinical cases showed about 0.2 to 0.5 milligram of lead per 100 cubic centimeter of blood.

The spectrographic method requires the use of 5 cubic centimeters of blood, 12 hours of time, the spectroscope and skill in its use. A clinical laboratory test of somewhat simpler character yet nearly as sensitive as the spectrographic method is described in *The Lancet*. By this test a cherry-red color is produced in the lower layer of a lead containing fluid when shaken with a solution of diphenyl-tricarbozone, or dithizone. The dithizone is made into a solution with either carbon tetrachloride or chloroform. As little as 0.001 milligram of lead may be detected by this method.

NOTES ON TRACHEOBRONCHITIS

In a symposium published in the *International Medical Digest* this is described as "the commonest malady met with in family prac-

tice" during the autumn and winter months. The common cold or acute infectious coryza is considered to be its forerunner and the treatment advocated is the treatment of the coryza by rest in bed for a few days. The room should be well ventilated but free from draughts and the temperature not above 70° F. or below 60° F. The writers of this symposium oppose nasal sprays because of the danger of politzerizing the eustachian tubes and encouraging the development of otitis media. Nose drops of albolene are advised. A nose drop containing 1 to 1,000 ephedrin or adrenalin may be used. A hot foot bath with or without mustard in the water, and a hot lemonade before the patient is put to bed (good old fashioned remedies) receive the approbation also of the most scientific pharmacologists. Alkalinization with bicarbonate of soda, alkaline mineral waters or the juices of citrus fruits are advocated. Not more than three teaspoonfuls of sodium bicarbonate should be used in 24 hours. Bland mouth washes and gargles are advocated, the time honored Dobell's solution or the liquor antisepticus or liquor antisepticus alkalinus. A simple cough mixture is often indicated. A steam kettle in the room, to which 10 to 20 drops of tincture of benzoin or oil of eucalyptus or the old time friar's balsam has been added, is very desirable. It prevents the excessive dryness in the air of the winter room and appears to be soothing to the tracheal and bronchial mucosa.

Even though fever is absent the diet should be largely liquid. Warm drinks and foods are to be preferred to cold. Hot milk and water, beef and chicken soups, jellies, and the juice of citrus fruits are best.

As every medical man is aware, these apparently mild respiratory infections should never be regarded lightly, particularly at this time of the year in northern climates, as otitis media with its dread sequelae of mastoiditis, sinus thrombosis and brain abscess; sinusitis, septic meningitis, and pneumonia are too frequently the fatal termination of a neglected cold.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review.)

SYPHILIS AND ITS TREATMENT, by *Wm. A. Hinton, M. D., Boston*, published by MacMillan Co., New York, 1936. \$3.50

This volume with its index contains 321 pages. It is gotten up in nice form, well printed, has no illustrations, and has an adequate index. There is little doubt that the book will prove one of the most useful of this year or, for that matter, of the present decade, as a dependable guide for medical students and practitioners of medicine who are of necessity unable to utilize the larger works on this subject. It is in three parts. Part 1 has to do with the manifestations of syphilis. Chapter 1, the parasite and the response of the host; chapter 2, occurrence, detection, and recognition of syphilis; chapter 3, the primary stage of syphilis; chapter 4, the secondary stage of syphilis; chapter 5, the tertiary stage of syphilis; chapter 6, syphilis and examinations of spinal fluid; chapter 7, syphilis and marriage; chapter 8, congenital syphilis. These several chapters take up 185 pages of the text. There are very few points with which one can find fault in the first part of this work. In choosing a test for syphilis, the author, who developed the Hinton flocculation test for this disease, makes out a "watertight" case for the greater accuracy of flocculation tests over the complement fixation test. In serum work this is true, but apparently he holds to the value of the Wassermann test in cerebrospinal fluids. The author prefers to use the word, the primary lesion of syphilis, instead of the word chancre. It is probably justifiable that the advice the author gives on page 52, in regard to the discovery of treponemes, as he prefers to call them, in the exudate of lesions in the mouth, tonsils, and tongue. This cannot be taken as of diagnostic importance. "Treponemes recovered from lesions on the outer surfaces of the lips signify syphilis unless the

lesions are caused by yaws and contain the *Treponema pertenue*, an organism similar in size and motility to the *T. pallidum*. On account of the morphologic similarity of the organisms, yaws cannot be distinguished from syphilis by dark-field examination." He might have added at this point, "nor by any other means known to medicine." The failure to recognize the identity of viruses here gives to physicians an enormous wastage of information about syphilis and causes many mistakes in their writing about it. To give another example of this, on page 118 the author tries to explain that the lack of treatment is what causes the absence of general paresis in the human being rather than any connection that this may have with severe secondary eruptions. That is to say, his belief is that cutaneous response has no effect in the prevention of nervous system complications. Among natives this is absolutely nullified because both in yaws so-called, and in what he himself would recognize as syphilis, among native peoples (who have severe dermic complications) there is little nervous involvement. These people never get any treatment or, at best, very little. There is no question that treatment is the best preventive of nervous disease involvement but there is also no question about the fact that severe dermic manifestations help to prevent nervous involvement in syphilis.

Part 2, Treatment—contains chapter 9, antisyphilitic medication; chapter 10, medical treatment of syphilis. The author's treatment is adequate in every way and his advice in this connection could perhaps better be summarized in his own words: "Briefly, then, the physician will succeed most often in controlling syphilis if he administers a few carefully chosen drugs promptly, intensively, continuously, for a long while and with a minimum of inconvenience and expense to the patient."

Part 3, Appendix—contains the technique of laboratory tests for syphilis and in this are detailed descriptions of dark-field examination, the Hinton test for syphilis (third modification), preparation of stock solutions for Hinton test, performing the Hinton test, and the technique for testing spinal fluid. Under this technique we have (1) Wassermann test, (2) cell count, (3) Ross-Jones test for globulin, (4) Lange's colloidal gold test and the method of preparing the gold solution and the technique of the test.

We feel that this book is adequate for the needs of the busy student and the active practitioner at the present time. It is a pleasure to review a book which has so many virtues and yet is given in such a concise and direct way. It is impossible to read through this book without the conviction that the modern treatment of syphilis is rapidly making of this disease one for the internist instead of the dermatologist, as the severe types of dermic syphilis are now rarely seen in the better populations except among the lowest classes. It

is within sight that in the better treated populations, the description of the many types of eruption in lues may be omitted. It is a pity we have not a term better suited to the findings of the uncomplicated action of *Treponema* upon the tissues than inflammation, as there is neither pain, heat, redness, nor swelling in these leutic reactions. When we have increased cell count, increased globulin, et cetera, in the cerebrospinal fluid, we have luetic change but it is not inflammation.

BASAL METABOLISM IN HEALTH AND DISEASE by *Eugene F. Dubois, M. D. Medical Director, Russell Sage Institute of Pathology; Professor of Medicine, Cornell University Medical College, New York*; Third edition, thoroughly revised, published 1936. Octavo, 494 pages, illustrated with 98 engravings. Lea and Febiger, Philadelphia, 1936. Cloth, \$5 net.

This well-revised edition is comprehensive, clear, authoritative, up-to-date, well indexed, and contains an excellent bibliography. It is divided into two parts. Part one, metabolism in health; part two, metabolism in disease. A new chapter on the physical channels of heat loss from the body has been added; other chapters have been partly rewritten and rearranged. The author has well accomplished his aim, "to bring basal metabolism out of the realm of pure physiology into the domain of clinical medicine." The book is written for those engaged in the practice of medicine and surgery, physiologists, medical students, and dietitians. Of special interest to every clinician are the chapters dealing with factors influencing normal metabolism, metabolism in undernutrition, overnutrition and obesity, diabetes, diseases of the thyroid, blood, heart, kidneys, and nervous system, basal metabolism and the adrenals, pituitary and sex glands, also evaluation of the basal metabolism tests.

THE THEORY AND PRACTICE OF PSYCHIATRY, by *William S. Sadler, M. D.* 1231 pages. The C. V. Mosby Co., St. Louis, 1936. Price \$10.

Dr. Sadler, who is chief psychiatrist and director of the Chicago Institute of Research and Diagnosis, has written a number of popular works such as *Worry and Nervousness* and *The Mind at Mischief*. He has here produced a new textbook of mental diseases for medical men. It is an excellent book and with a number of features that are unique among such volumes. In the first place, it is written as a general practitioner's guide primarily and pays most attention to neuroses and personality problems leading to social difficulties, the sort of cases most frequently met in general practice. Next, and this is another practical feature, it deals with the psychiatric problems of all age groups, devoting special attention to childhood. Furthermore, it is written by a psychiatrist in private practice and the whole approach is noninstitutional, another refreshing departure. There is an interesting glossary amounting to a dictionary of psy-

chology and psychiatry. The straightforwardness and simplicity of language, and the large amount of space devoted to prevention of mental disease and social maladjustments, make it a valuable work for ministers, teachers, and social workers.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. *Edited by Richard M. Hewitt, B. A., M. A., M. D.; Lloyd G. Potter and A. B. Nevling, M. D.* Volume XXVII, 1935. Published May 1936. Philadelphia and London. W. B. Saunders Co., 1936.

This is the 27th volume of these papers assembling under one cover material of value to nearly all branches of medicine and surgery. The volume is larger than in recent years, comprising 1,353 pages and presenting 267 topics, the work of 236 authors and collaborators. In addition there is a generous list of other papers by table and reference only.

Most of the papers in the volume are abridgements or abstracts of publications. Their peculiar value lies in their readability and the fact that the essential points of the subject may be grasped quickly without the necessity of covering a lot of extraneous ground. However, the source of the complete text of each paper is given so that further study may be easily carried out if the reader wishes. Some of the more important papers and lectures have been reproduced in full in this volume.

It is obviously impracticable to attempt to review each individual paper. However, certain features are of note. There is conservatism in reporting new procedures and drugs and the results attained therefrom. One is also impressed by the large series of patients and the excellent follow-up systems which guarantee an unbiased and accurate estimate of the value of certain lines of treatment. This is reflected in the character of the papers by the honesty of opinions, lack of dogmatism, and acknowledgement of mistakes where end-results point the right way.

CLINICAL HEART DISEASE, by *Samuel A. Levine, M. D.* 430 pp. W. B. Saunders Co. \$5.50.

The author, an outstanding clinician, teacher, and research student, accurately describes this book in the preface as "a presentation in simple form of the important aspects of the diagnosis, prognosis, and treatment of heart disease."

Based on a personal experience of many years in hospital, laboratory, and consultation practice (both civilian and military), detailed methods of diagnosis, together with the therapeutic measures employed for the treatment and management of each particular condition are discussed in monographic form in 20 chapters. These deal with rheumatic fever; rheumatic heart disease; diseases of the pericardium; angina pectoris and coronary thrombosis; hypertensive

heart disease; arteriosclerosis and chronic myocarditis; thyroid, syphilitic, congenital and functional heart disease; bacterial endocarditis; paroxysmal rapid heart action; acute cardio-vascular emergencies; heart disease as a surgical or obstetrical risk; dyspnea; prognosis in heart disease; and treatment of congestive heart failure.

The final chapter is devoted to clinical electrocardiography. It comprises 114 pages and contains over 400 fully described electrocardiograms, covering the entire field of normal and abnormal tracings. This chapter could have been published separately as an excellent manual of clinical electrocardiography.

The subject matter is presented very clearly and concisely; there are no references given and the text reads as interestingly as a clinical lecture.

The chapter on heart disease as a surgical or obstetrical risk is a most valuable discussion of this important and difficult problem.

All military-medical men, as well as physicians in active practice, must of necessity have a sound working knowledge of heart disease. This book is recommended as fulfilling their requirement in every respect.

VASCULAR DISORDERS OF THE LIMBS, by *Sir Thomas Lewis, M. D., F. R. S.* 111 pages. The Macmillan Company, New York. 1936. \$2.

This little book by one of the most eminent cardiologists in the world is a model of a book of clinical study and research. The style is simple and the description of the mechanism by which the clinical symptoms of each disorder are produced is so excellent that the reader cannot fail to obtain a clear picture of such conditions as thromboangeitis, arteriosclerosis, intermittent claudication, Raynaud's disease, and gangrene.

ENDOCRINOLOGY IN MODERN PRACTICE, by *William Wolf, M. D., M. S., Ph. D.* 1,018 pages, illustrated. W. B. Saunders Co., Philadelphia and London. 1936. \$10.

It takes a good deal of courage to write a 1,000-page book on so changing a subject as endocrinology. Dr. Wolf in spite of the many obvious difficulties has done the work well and as far as possible given the basic functions and relationships of the endocrine glands as now known. Very practical and helpful are the diagrams and tables that show the symptoms and signs believed characteristic of glandular disturbances. There is a section devoted to the interpretation of laboratory findings, a section on technique of laboratory procedures, and a most interesting section on bone development and anthropometry. The concluding chapter contains a description and dosage of commercially available endocrine products, and there is an excellent index.

THE ART OF TREATMENT, by *William R. Houston, A. M., M. D., F. A. C. P.* 744 pages. The Macmillan Company, New York. 1936. \$5.

Medicine began as an art and despite the development of the medical sciences must always remain an art. It is the emphasis placed upon it as an art that makes the Hippocratic writings of value today to the modern physician and was one of the features of Osler's textbook that made it one of the most widely used of modern works on the practice of medicine. This is the keynote, too, of Dr. Houston's book—the art of therapeutics. Do not think, however, that scientific aspects are neglected. He gives the quintessence of scientific treatment but applied with practical common sense.

HYGIENE AND SANITATION. A TEXT BOOK FOR NURSES, by *George M. Price, M. D.* 295 pages. Sixth edition, 1936. Lea & Febiger, Philadelphia. \$2.25.

EYE, EAR, NOSE AND THROAT MANUAL FOR NURSES, by *Roy H. Parkinson, M. D.* 232 pages. Third edition, 1936. C. V. Mosby Co., St. Louis, Mo. \$2.25.

FOOD-BORNE INFECTIONS AND INTOXICATIONS, by *Fred W. Tanner, B. S., M. S., Ph. D., Professor of Bacteriology, University of Illinois.* 439 pages. Twin City Printing Co., Champaign, Ill. 1933. \$5.50.

This is a summary of all types of food poisoning and gives a history of many important outbreaks with bibliographical reference.

EXOPHTHALMIC GOITER AND ITS MEDICAL TREATMENT, by *Israel Bram, M. D.* Second edition, 1936. 476 pages, 79 illustrations. The C. V. Mosby Co., St. Louis, Mo. \$6.

This is an interesting monograph by one who has specialized in endocrinology. A feature of the book is the large number of case histories given, each with a significant lesson. Another feature is the attention given to psychotherapy and study recommended of the patient's environment and the correction of unfavorable factors in it.

PREVENTIVE MEDICINE, by *Mark F. Boyd, M. D., M. S.* 561 pages, illustrated. Fifth edition, 1936. W. B. Saunders Co., Philadelphia and London. \$4.50.

The demand for a fifth edition is evidence that a book is likely to soon reach the desired place of being well known to the medical profession. Certainly it deserves it. This edition has been thoroughly revised and much new matter added, particularly regarding the vitamins, silicosis, morbidity incidence, mottled enamel, rats, and many of the infectious diseases such as colds, psittacosis, poliomyelitis, and relapsing fever.

WILLIAMS' OBSTETRICS, by *Henricus J. Stander, M. D., F. A. C. S.* Seventh edition. A revision and enlargement of the text originally written by J. Whitridge Williams. 1,269 pages, illustrated. D. Appleton Century Company, New York and London. 1936. \$10.

Williams textbook of obstetrics has long been a standard work familiar to a generation of medical students and physicians. Hirst's

obstetrics is well known for the excellence of its surgical applications to the subject. DeLee's text for the emphasis placed upon internal medicine in relation to the subject. A feature of Dr. Williams' book has always been a large amount of space devoted to pathology and to the anatomy, physiology, and embryology. Dr. Stander has maintained this characteristic of the book in this revision. The text has also been increased. This edition has been enriched by more than 150 new illustrations drawn principally by Elizabeth Broedel and many of the old illustrations have been replaced or improved.

THE EYE AND ITS DISEASES, by 82 international authorities. Edited by Conrad Berens, M. D. 1,254 pages, 436 illustrations, some in colors. W. B. Saunders Company, Philadelphia and London. 1936. \$12.

Following the example of Christopher's new textbook of surgery, written by a number of authors, we now have a manual of ophthalmology prepared by a number of noted specialists and edited by Dr. Berens. The book is very complete, most up-to-date, and probably as authoritative as any work in print on the subject.

AN INTRODUCTION TO MATERIA MEDICA AND PHARMACOLOGY, by Hugh Alister McGuigan, Ph. D., M. D., Professor of Materia Medica, Pharmacology, and Therapeutics, University of Illinois, College of Medicine, Chicago, and Edith P. Brodie, A. B., R. N. 580 pages with 71 text illustrations and 18 color plates. The C. V. Mosby Company, St. Louis, Mo. 1936. Price \$2.75.

MICROBIOLOGY AND PATHOLOGY FOR NURSES, by Charles F. Carter, B. S., M. D., Director Carter's Clinical Laboratory, Dallas, Tex. 682 pages with 138 text illustrations and 14 color plates. The C. V. Mosby Company, St. Louis, Mo. 1936. Price \$3.

These are two excellent textbooks for nurses.

ORAL HYGIENE AND THE TREATMENT OF PARODONTAL DISEASES, by Russell W. Bunting, D. D. Sc., Professor of Oral Histology and Pathology in the School of Dentistry of the University of Michigan, Ann Arbor, Mich. 187 pages with 80 engravings. Lea & Febiger, Philadelphia, Pa. 1936. Price \$2.50.

An excellent exposition of the principles of oral hygiene.

OPERATIVE AND INTERPRETIVE RADIODONTIA, by Walter S. Thompson, D. D. X., Associate Professor of Radiodontia, College of Dentistry, University of Southern California; Lieutenant, United States Naval Reserve. 374 pages. 355 engravings. Lea & Febiger, Philadelphia, Pa. 1936. Price \$7.

This is a splendid manual of dental roentgenography dealing both with the backers of technique and interpretation. The book has many practical features, including such things as the effect of weather conditions upon the developing of films, mounts, preservation, and the ownership of films.

DISINFECTION AND STERILIZATION, by *Ernest C. McCulloch, M. A., D. V. M., Ph. D., Biological Research, Pennsylvania Salt Manufacturing Co.* 525 pages, 53 engravings. Lea & Febiger, Philadelphia, Pa. 1936. Price \$5.

This is a book which has been needed for some time. It covers the old subject of disinfection and sterilization from the standpoint of the engineer and the bacteriologist. All agents are carefully and scientifically considered. The whole subject of pasteurization of milk is dealt with in a very thorough manner, as is also the subjects of water purification and the disinfection of sewage. It is a valuable reference book for the engineer, the physician, the bacteriologist, and the public hygienist.

THE PATIENT AND THE WEATHER, by *William F. Petersen, M. D.*, with the assistance of *Margaret E. Milliken, S. M.* Volume I, part 2, AUTONOMIC INTEGRATION. 781 pages. Numerous maps, drafts, and tables, as well as some other illustrations. Edwards Brothers, Inc., Ann Arbor, Mich. 1936. Price \$9.

This is a continuation of Dr. Petersen's studies on relation of climate and weather to physiological function and well-being, and represents a scientific attack upon a problem which has had but few students since the time of Hippocrates. Indeed Doctor Petersen is a modern pioneer in the subject and like all pioneers he has met a great many difficulties and has spared neither time nor effort to conquer them. Naval medical officers should be particularly interested in this work for they have unparalleled opportunities to observe the effects of sudden changes in climate and weather upon man.

CHEMICAL PROCEDURES FOR CLINICAL LABORATORIES, by *Marjorie R. Matlice, A. B., Sc. M., Assistant Professor of Clinical Pathology, New York Post-Graduate Medical School of Columbia University.* 520 pages. 90 engravings and 2 colored plates. Lea & Febiger, Philadelphia, Pa. 1936. Price \$6.50.

This is an excellent practical guide in human biological chemistry. An interesting feature is the section devoted to metals in biological specimens, often a point of great practical importance. The only criticism is that this chapter is too short; it would seem desirable to have all the other important toxic metals included in it. The book is well written. It is at once terse yet complete.

AN INTRODUCTION TO PSYCHOLOGICAL MEDICINE, by *R. G. Gordon, M. D., D. Sc., F. R. C. P. (Ed.), Physician to Royal United Hospital, Bath; N. G. Harris, M. D., B. S. (Lond.), D. P. M., Physician in charge to Woodside Hospital, and J. R. Rees, M. A., M. D., D. P. H. (Camb.), Medical Director, Institute of Medical Psychology.* 386 pages. Oxford University Press, New York City. 1936. Price \$4.

This book is a course in elementary psychology and a hand manual of mental tests.

LEHRBUCH DER MILITARHYGIENE (HAND BOOK OF MILITARY MEDICINE), written by various authors and compiled by Prof. Dr. A. Waldmann and Prof. Dr. W. Hoffman of Berlin. Paper cover. 759 pages. 174 pictures and numerous tables. Julius Springer, Berlin. 1936. 45 marks.

This book has not yet been translated into English. It is a very extensive and exhaustive manual of military medicine. In comparing it with works on military hygiene and military medicine in English, the reviewer was struck by several important differences. In the first place a great deal more time and space was devoted to hospital construction and to the epidemiology of the various diseases, particularly in relation to the military aspects, than is usually found in English or American books.

There is a very small section on ship and tropical hygiene. Nothing is said about the handling of the wounded, either in the field or on shipboard.

The material on aviation medicine and chemical warfare also appears to be very much smaller than is found in texts in English.

A feature of the book is its fine paper and type and magnificent tables and illustrations.

MATERIA MEDICA AND THERAPEUTICS, by Linette A. Parker, B. Sc. (Columbia Univ.), R. N. Sixth edition. 377 pages with 32 engravings and 3 plates. Lea & Febiger, Philadelphia, Pa. 1936. Price \$2.50.

A book that has passed through six editions has proved its usefulness. This standard work for nurses has been revised to conform to the eleventh revision of the United States Pharmacopoeia.

THE DIVISION OF PREVENTIVE MEDICINE

C. S. STEPHENSON, Commander, Medical Corps, United States Navy, in charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS EMPLOYED IN THE TREATMENT OF DISEASE IN THE UNITED STATES NAVY, 1935

By C. S. STEPHENSON, Medical Corps, United States Navy, and E. H. WINGO, Chief Pharmacist's Mate
United States Navy

Since November 1924 medical officers of the Navy have been required to make monthly reports of the number of doses of arsenicals administered and a separate account of each case in which ill effects are noted. During the 11 years, 1925-35, in which this information has been compiled 1,096,220 doses of arsenicals have been administered and 848 reactions have been reported.

Previous articles dealing with the information obtained from these reports were published in the September 1925, January 1927, January 1929, July 1930, October 1931, October 1932, April 1933, October 1933, October 1934, January 1935, October 1935, January 1936, and October 1936 numbers of the UNITED STATES NAVAL MEDICAL BULLETIN. Cases of arsenical dermatitis occurring during the year 1935 were published in the October 1936 number of the NAVAL MEDICAL BULLETIN. The present article deals with all cases, except arsenical dermatitis, which were reported during the year 1935. Comparative figures from the experience of previous years are also presented.

TABLE 1.—*Arsenical reactions, 1935*

Classification	Arsphenamine, neoarsphenamine, sulpharsphenamine, and tryparsamide reactions			
	Mild	Severe	Fatal	Total
Vasomotor phenomena.....	45	1	0	46
Arsenical dermatitis ¹	22	18	0	40
Blood dyscrasias.....	2	6	1	9
Gastrointestinal.....	5	1	0	6
Liver damage (jaundice).....	2	1	0	3
Vascular damage (probable adrenal hemorrhage).....	0	0	1	1
Acute renal damage.....	0	1	0	1
Optic neuritis.....	1	0	0	1
Total.....	77	28	2	107

¹ Case histories were published in the October 1936 number of the Bulletin. Included in the above table are two mild reactions caused by arsphenamine, 2 reactions, 1 mild and 1 severe, caused by sulpharsphenamine, and 1 mild reaction caused by tryparsamide.

TABLE 2.—*Arsenicals administered during the year 1935 for all diseases, including syphilis*

Drug	Dose				Total
	0.9 to 3 grams	0.9 gram	0.6 to 0.9 gram	Less than 0.6 gram	
Arsphenamine:					
Navy.....	0	0	0	3,525	3,525
All others.....	0	0	0	49	49
Bismarsen:					
Navy.....	0	0	0	294	294
All others.....	0	0	0	340	340
Mapharsen:					
Navy.....	0	0	0	438	438
All others.....	0	0	0	135	135
Neoarsphenamine:					
Navy.....	0	8	32,415	56,536	88,959
All others.....	0	0	3,865	20,862	24,727
Silver arsphenamine:					
Navy.....	0	0	0	232	232
All others.....	0	0	0	42	42
Sulpharsphenamine:					
Navy.....	0	0	47	2,317	2,364
All others.....	0	0	33	2,918	2,951
Tryparsamide:					
Navy.....	4,513	0	0	0	4,513
All others.....	884	0	0	0	884
Total.....	5,397	8	36,360	87,688	129,453

TABLE 3.—*Arsenicals administered during the 4-year period, 1932-35, for all diseases, including syphilis*

Drug	Dose				Total
	0.9 to 3 grams	0.9 gram	0.6 to 0.9 gram	Less than 0.6 gram	
Acetarsonic:					
Navy.....	0	0	0	0	0
All others.....	0	0	76	729	805
Arsphenamine:					
Navy.....	0	0	81	6,518	6,599
All others.....	0	0	0	103	103
Bismarsen:					
Navy.....	0	0	0	411	411
All others.....	0	0	1	480	481
Mapharsen:					
Navy.....	0	0	0	438	438
All others.....	0	0	0	135	135
Neoarsphenamine:					
Navy.....	0	4,483	166,389	237,470	408,342
All others.....	0	373	21,024	68,776	90,173
Silver arsphenamine:					
Navy.....	0	0	0	279	279
All others.....	0	0	0	190	190
Sulpharsphenamine:					
Navy.....	0	18	143	5,345	5,506
All others.....	0	3	43	7,839	7,885
Tryparsamide:					
Navy.....	11,783	0	0	10	11,793
All others.....	8,041	0	0	5	8,046
Total.....	19,824	4,877	187,757	328,728	541,186

TABLE 4.—Deaths and severe reactions following the administration of 994,176 doses neoarsphenamine, 1925–35. Ratio of deaths and severe reactions to doses

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Num- ber	Ratio to doses 1 to—	Num- ber	Ratio to doses 1 to—	Num- ber	Ratio to doses 1 to—
Hemorrhagic encephalitis.....	14	71, 012	0	-----	14	71, 012
Arsenical dermatitis.....	8	124, 272	155	6, 414	163	6, 099
Vasomotor phenomena.....	6	165, 696	55	18, 075	61	16, 297
Blood dyscrasias.....	5	198, 835	17	58, 480	22	45, 189
Acute renal damage.....	2	497, 088	5	198, 835	7	142, 025
Acute yellow atrophy of the liver.....	2	497, 088	0	-----	2	497, 088
Vascular damage (probable renal hemorrhage) ¹	1	994, 176	0	-----	1	994, 176
Liver damage.....	0	-----	13	76, 475	13	76, 475
Jarisch-Herxheimer.....	0	-----	2	497, 088	2	497, 088
Polynuritis.....	0	-----	1	994, 176	1	994, 176
Border-line hemorrhagic encephalitis ²	0	-----	1	994, 176	1	994, 176
Arsenical neuritis ³	0	-----	1	994, 176	1	994, 176
Gastrointestinal.....	0	-----	1	994, 176	1	994, 176
Total.....	38	26, 162	251	3, 956	289	3, 440

¹ First classified during the year 1935.² First classified during the year 1934.³ First classified during the year 1933.

The following is a special study by years made by Commander S. S. Cook, Medical Corps, United States Navy, of the number and causes of deaths attributed to arsenical poisoning:¹

	Year																
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935
Acute pancreatitis.....												1					
Arsenical dermatitis.....	1			1		1			1	3				1	2	1	
Blood dyscrasias.....				1				1	1	2	2	1				1	1
Bronchial pneumonia.....														1			
Cause unknown.....		1													1		
Hemorrhagic encephalitis.....	1	2	1	3	1	2	2	4	3	2				2		1	
Liver and kidney damage.....	1		1						1		1						
Multiple emboli.....	1																
Unneutralized arsenoben- zol.....				1													
Vascular damage.....				1		1			1						4		1
Total.....	4	3	4	5	1	4	2	5	7	7	3	2	0	4	7	3	2

Total deaths, 63

TABLE 5.—Deaths following administration of arsenical compounds, 1919–35

Year	Arsphen- amine	Neoars- phenam- ine	Total	Year	Arsphen- amine	Neoars- phenam- ine	Total
1919.....	3	0	3	1929.....	0	3	3
1920.....	1	1	2	1930.....	0	3	3
1921.....	3	1	4	1931.....	0	0	0
1922.....	0	4	4	1932.....	0	4	4
1923.....	0	1	1	1933.....	0	7	7
1924.....	1	2	3	1934.....	0	3	3
1925.....	0	2	2	1935.....	0	2	2
1926.....	0	4	4				
1927.....	1	4	5	Total.....	9	47	56
1928.....	0	6	6				

¹ U. S. NAVAL MEDICAL BULLETIN, July 1934; "Deaths following the administration of arsenicals in the U. S. Navy, 1919–35", by Commander S. S. Cook, Medical Corps, U. S. Navy. A restudy of the records of deaths following the administration of arsenical compounds revealed the fact that deaths in the years: 1919, 1920, 1922, 1924, 1926, 1927, 1928, and 1930 were recorded as indicated in the above table.

NUMBER OF PERSONS TREATED FOR SYPHILIS AND FOR OTHER DISEASES

On December 31 of each year each activity records and reports to the Bureau of Medicine and Surgery, on N. M. S. Form A, the number of persons in that command who have a history of syphilis, and the number of those in the command who were treated during the year with an arsenical compound, heavy metal, or other antiluetic treatment. The census also requires the recording and reporting of the number of persons who were treated during the year with an arsenical compound for a disease other than syphilis. This census does not take into account those individuals who left the service during the year.

In the table which follows, treatment data have been separated into that given to active service personnel and that given to all others. The term "all others" includes Veterans' Administration patients, dependents of naval personnel, retired naval personnel, and native populations of insular possessions.

TABLE 6.—*Syphilis and arsenicals, U. S. Navy, 1935*

	U. S. Navy	All others	Total (persons)
Strength, Dec. 31, 1935.....	117, 149		117, 149
Syphilis census, Dec. 31, 1935.....	14, 897		14, 897
1. Number of persons treated for syphilis with—			
(a) Arsenicals:			
Arsphenamine.....	187	24	211
Bismarsen.....	13	25	38
Mapharsen.....	37	14	51
Neosarsphenamine.....	5, 916	1, 275	7, 191
Silver arsphenamine.....	15	3	18
Sulpharsphenamine.....	201	54	255
Tryparsamide.....	142	62	204
Total.....	6, 511	1, 457	7, 968
(b) Other treatment:			
Bismuth compounds.....	5, 606	925	6, 531
Mercury compounds.....	658	165	823
Mixed treatment (specific mixture, etc.).....	219	0	219
Potassium iodide.....	235	93	328
Total.....	6, 718	1, 183	7, 901
Total (a) and (b).....	13, 229	2, 640	15, 869
2. Number of persons treated for other diseases:			
Neosarsphenamine.....	225	985	1, 210
Sulpharsphenamine.....	1	365	366
Fowler's solution.....	17	0	17
Bismuth compounds.....	1	284	285
Mixed treatment (specific mixture, etc.).....	1	0	1
Total.....	245	1, 634	1, 879
Grand total.....	13, 474	4, 274	17, 748

In table 6 it will be noted that 245 service personnel and 1,634 non-service personnel were treated for diseases other than syphilis during the year 1935.

Of the 245 naval personnel, 220 were treated for Vincent's infection, 8 for chancroid, 3 for scabies, 1 for yaws, and 13 for other diseases.

Of the 1,634 persons in the group "all others", 1,594 were treated for yaws and 40 for Vincent's infection.

VASOMOTOR PHENOMENA

Sulpharsphenamine.—(42—1935.) A patient after exposure on March 28, 1934, developed a penile lesion which was positive for *Treponema pallidum* on April 17, 1934.

Arsenical treatment began on April 17, and he received eight injections for a total of 3.6 grams of neoarsphenamine between that date and June 19. From June 19 to July 9 he received four injections of sulpharsphenamine for a total of 1.3 grams. On February 5, 1935, he received a 0.3-gram injection of sulpharsphenamine, followed by 0.4 gram on February 12, and 0.3 gram on February 19. As concurrent treatment he was given 41 injections for a total of 4.1 grams of thiobismol.

Two minutes after the last injection of sulpharsphenamine, the patient walked into the ward and collapsed. His face, neck, chest, and arms became cyanotic; face was swollen, especially around the eyes; pulse was weak, the radial and temporal pulse could not be felt; breathing was difficult; and he vomited. He was given 1 cubic centimeter of adrenalin hypodermically, and 5 minutes later he began to assume his natural color. Ten minutes later 0.6 gram of sodium thiosulphate was administered intravenously. Temperature was 102.6° F.; pulse, 110; and respirations, 25, and remained at this level for 2 hours. Five hours after the injection of sulpharsphenamine, temperature, pulse, and respirations were normal, and he felt well.

Although recovery was completed in 5 hours, he remained under observation for 2 days.

Neoarsphenamine.—(41—1935.) A patient, infected October 1, 1934, was given a diagnosis of syphilis November 6, 1934. Diagnosis made by positive darkfield examination of the lesion on the sulcus of the penis, and by a positive Wassermann blood reaction.

Treatment began on November 7, 1934, and he received two injections of an arsenical compound (name and amount not stated), and two injections of bismuth salicylate. Treatment was continued, and he received 0.6-gram injections of neoarsphenamine on December 4, 11, 18, and 28, 1934, and January 4, 15, and 22, 1935. As concurrent treatment, eight injections of bismuth salicylate were given.

One and one-half hours after the last injection of neoarsphenamine, the patient complained of general malaise and headache; temperature, 102° F.; pulse, 100; and respirations, 20.

Recovery within 24 hours.

(43—1935.) A patient was infected in March 1931. From August 20, 1931, when treatment was begun, to July 18, 1933, he received 47 injections of an arsenical compound (name and amount not stated). As concurrent treatment, he was given 14 injections of bismosol and 36 injections of bismuth salicylate.

The seventh course of arsenical treatment began January 3, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.45-gram injections on January 7, 15, 22, 29, and February 5.

Three hours after the last injection the patient complained of general malaise, headache, and slight nausea. Temperature was 102° F.; pulse, 100; and respirations, 20. The skin felt hot and dry, with slight erythema of the skin and mucous membrane. One-half cubic centimeter of adrenalin was administered hypodermically.

Recovery in 1 day.

(44—1935.) This patient was infected September 30, 1933, developing an ulcer on the scrotum which was positive for *Treponema pallidum*. Repeated Kahn blood tests were 4 plus.

From November 14, 1933, to November 19, 1934, he received 2 injections of neoarsphenamine and 15 injections of an arsenical compound (type and amount not stated). As concurrent treatment, 26 injections of bismosol were given.

He received a 0.3-gram injection of neoarsphenamine November 22, 1934, and 0.45-gram injections on November 29 and December 13, 1934, and January 17; 24, and 30, 1935.

About 1½ hours after the last injection the patient complained of general malaise, headache, and chills. Temperature, 99.6° F.; pulse, 105; and respirations, 25. Face was flushed and the conjunctivæ injected. He was given 1 gram of sodium thiosulphate intravenously.

Recovery within 4 hours.

(45—1935.) A patient was given a diagnosis of syphilis on November 16, 1931, because of positive clinical and serological findings. From November 17, 1931, to January 5, 1932, he received eight injections of neoarsphenamine, and from February 15 to June 2, an unstated amount of neoarsphenamine. As concurrent treatment, 16 injections of bismosol, 1 cubic centimeter each, were given.

He received a 0.3-gram injection of neoarsphenamine January 1, 1935, and 0.45-gram injections on January 22, 29, and February 5.

Four hours after the last injection the patient complained of malaise, headache, and slight nausea. Temperature, 102° F.; pulse, 100; and respiration, 20. The skin and mucous membrane were flushed. One-half cubic centimeter of adrenalin was given hypodermically.

Recovery within 24 hours.

(46—1935.) A patient was given a diagnosis of syphilis on January 24, 1934, because of an ulcerated sore on the prepuce and a 4 plus Kahn blood test.

From January 24 to December 5, 1934, he received 25 injections of neoarsphenamine, for a total of 13.1 grams, 24 injections of bismosol, and 12 injections of bismuth salicylate.

On January 7, 1935, the fourth course of arsenical treatment began with a 0.3 gram injection of neoarsphenamine, followed by 0.5 gram injections on January 15, 29, February 5, 12, 19, and March 5.

One minute after the last injection the patient developed a sense of suffocation, numbness, and faintness. The skin of the head and neck was markedly flushed. The pulse was bounding. He received 1 cubic centimeter of adrenalin hypodermically, and 1 gram of sodium thiosulphate intravenously. The numbness disappeared within 24 hours after the injection of sodium thiosulphate.

Recovery in 3 days.

(47—1935.) A patient was infected on October 7, 1934, and on October 16 a chancre of the penis developed which was positive for *Treponema pallidum*. A Kahn blood test was 4 plus on October 19, 1934.

Arsenical treatment was begun November 20, 1934, with a 0.3 gram injection of neoarsphenamine, followed by 0.3 gram on November 27 and 0.3 gram on January 11, 1935.

Five hours after the last injection the patient complained of malaise, headache, sore eyes and throat. Temperature, 103.6° F. There was marked conjunctival injection and redness and swelling of the pharyngeal mucosa. Pulse was full and rapid, blood pressure 136/80. He received 1 gram of sodium thiosulphate intravenously.

Recovery within 48 hours.

(48—1935.) This patient was given a diagnosis of syphilis January 31, 1935, because of enlarged inguinal glands, mucous patches in his mouth, a slight rash on abdomen, a healed lesion on the penis which appeared on January 2, and a 4 plus Kahn blood test.

Arsenical treatment began February 4, 1935, with a 0.3 gram injection of neoarsphenamine. Seven and one-half hours after the injection he complained of headache and pain in the back of the head and neck. Temperature 103° F., and pulse 120. He received 10 minims of epinephrine hydrochloride hypodermically and 0.5 gram of sodium thiosulphate the following morning.

Recovery in 24 hours.

(49—1935.) A patient who was infected February 20, 1934, developed three ulcerated sores on the glans penis. The Kahn blood test was 4 plus.

From March 20 to September 25, 1934, he received 16 injections of neoarsphenamine, for a total of 7.5 grams, and, as concurrent treatment, 12 injections of bismuth salicylate and 10 injections of mercuric succinimide.

The third course of arsenical treatment began January 8, 1935, with a 0.3 gram injection of neoarsphenamine, followed by 0.45 gram January 15 and 0.5 gram February 5 and 12, 1935.

Two minutes after the last injection the patient developed a generalized flush, loss of pulse, and collapsed. He received 1 gram of

sodium thiosulphate intravenously, and 5 minims of adrenalin hypodermically.

Recovery within 3 hours.

(50—1935.) This patient began antiluetic treatment September 15, 1932, and received 48 injections for a total of 21.6 grams of an arsenical compound (type not stated), 41 injections of bismuth salicylate, and 21 injections of mercury succinimide.

He received a 0.3 gram injection of neoarsphenamine March 12, 1935, the first injection of the sixth course of arsenical treatment. Five minutes after the injection he developed chills, nausea, and vomiting, and complained of a sensation of intracranial pressure. He received three-eighths grain of ephedrine sulphate by mouth, followed by 1 gram of sodium thiosulphate intravenously.

Recovery in 20 hours.

(51—1935.) Antiluetic treatment in this case began March 21, 1935, with a 0.3 gram injection of neoarsphenamine, followed by a 0.45 gram injection on March 28. Also received 3 injections of bismuth salicylate. Five minutes after the last injection of neoarsphenamine the patient reported bleeding from the needle puncture. He soon became pale and asked to sit down. Ten minutes later stated that he felt well, but still showed signs of shock. Thirty minutes later a slight headache developed.

Recovery in 3 hours.

(52—1935.) A patient was given a diagnosis of syphilis because of clinical and serological findings. Arsenical treatment began April 10, 1935, with a 0.3 gram injection of neoarsphenamine, followed by a 0.6 gram injection April 17. He also received two injections of bismosol. Eight hours after the last injection of neoarsphenamine the patient developed chills. Temperature, 101° F.; pulse, 98; and respirations, 18. The face was flushed, pulse full, and he complained of headache and weakness. He received 1 gram of sodium thiosulphate intravenously.

Recovery in 2 days.

(53—1935.) This patient developed a small lesion on the penis and general glandular enlargement after exposure April 21, 1935. Repeated darkfield examinations were positive for *Treponema pallidum* and a Kahn blood test was 2 plus.

Arsenical treatment was started May 20, 1935, with a 0.3-gram injection of neoarsphenamine, and the patient reported the following morning that he had chills and fever during the night. Examination at this time was negative and it was thought that the reaction may have been a mild Herxheimer manifestation.

Arsenical treatment was continued and he received a 0.45-gram injection of neoarsphenamine on May 23 without evidence of reaction. On May 30 he received a 0.45-gram injection of neoarsphenamine and

5 hours later complained of feeling chilly. Examination showed moderate injection of conjunctivae and slight flush of the face and neck. Temperature, 103° F.; pulse, 130; and respirations, 32. He was given 8 drops of epinephrine hypodermically. Temperature, 104.2° F.; pulse, 134; and respirations, 36. Alcohol baths under an electric fan were required every 15 minutes to keep the temperature at 104° F. The patient's temperature began to drop 18 hours after the injection of neoarsphenamine and was normal within 24 hours.

Recovery in 2 days.

At 9 a. m. June 6, 1935, he received a 0.2-gram injection of neoarsphenamine and at 2 p. m. reported to the sick bay with temperature 100.4° F., pulse 96, and respirations 24. He had no other complaints.

(54—1935.) A patient who was infected January 3, 1935, developed several small ulcerations on the corona of the penis which were positive for *Treponema pallidum*. The inguinal and cervical glands were enlarged, and a Kahn blood test was 4 plus.

From February 14 to March 26, 1935, he received 6 injections of neoarsphenamine, for a total of 2.6 grams, and from March 18 to June 3, 12 injections (24 grains) of bismuth salicylate.

On June 4, 1935, he received a 0.1-gram injection of neoarsphenamine, the first of the second course of arsenical treatment. One minute after the injection the patient developed malaise, flushing of the head and neck, with some paresthesia over the same area.

All symptoms disappeared within 10 minutes.

(55—1935.) A patient was given a diagnosis of syphilis in March 1932 because of an ulcer on his penis, general adenopathy, and a positive Kahn blood test.

From April 2, 1932, to December 1933, he received 17 injections of neoarsphenamine, 7 injections of an arsenical compound (type not stated), 18 injections of bismosol, and an unstated amount of mercury inunctions.

He was reinfected after exposure on October 26, 1934. One month after exposure he developed a lesion on the penis, followed by a papular pustular rash on body and extremities. Temperature, 100° F. A Kahn blood test was 4 plus on December 30, 1934.

December 29, 1934, to February 14, 1935, he received seven injections of neoarsphenamine, for a total of 4.35 grams, and seven injections of mercury.

On April 18 he received a 0.3-gram injection of neoarsphenamine, followed by nine weekly injections of 0.6 gram each. Three minutes after the last injection given on June 18, the patient felt faint, the face and lips had a grayish color, skin was cold and moist, and the pulse was 80 and weak. He received 1 gram of sodium thiosulphate intravenously.

Recovery in 1½ hours.

(56—1935.) A patient was infected January 3, 1930. He developed a typical chancre on the shaft of the penis which was positive for *Treponema pallidum*.

From February 15, 1930, to September 16, 1931, he received 14 injections for a total of 7.65 grams of neoarsphenamine, 15 injections of bismuth salicylate, and 11 injections of mercury. After the last injection of neoarsphenamine, which was administered September 16, the patient experienced a severe liver damage (jaundice) reaction, with recovery in 21 days. Arsenical treatment was discontinued.

From September 16, 1931, to April 3, 1934, he was given 14 injections of bismuth salicylate and 8 injections of mercury.

The patient was reinfected on February 5, 1935. He developed a small ulcer on the penis which was positive for *Treponema pallidum* on three successive darkfield examinations. After the second infection it was decided to try further arsenical medication by the intravenous route. Between the dates of February 11 and March 6, 1935, he received three injections of neoarsphenamine for a total of 2.1 grams. Nausea followed each injection. As concurrent treatment he received 10 injections of bismuth salicylate and 7 injections of iodo-bismatol.

On June 4 he received a 0.15-gram injection of neoarsphenamine. Immediately after the injection there developed violent nausea and vomiting, flushed face, feeble and rapid pulse, profuse sweating, and prostration. Urinalysis showed 2 plus albumin and Dickens' test positive. He received 1 gram of sodium thiosulphate intravenously and 15 minims of epinephrine hydrochloride hypodermically.

Recovery in 24 hours.

(57, 58—1935.) This patient was infected April 5, 1935, and developed a chancre on the shaft of the penis which was positive for *Treponema pallidum*.

Arsenical treatment began May 21, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.6 gram on May 28. Forty-eight hours after the last injection the patient reported with chills, temperature 103.6° F., pulse 104, and respirations 22. The following day the temperature, pulse, and respirations were normal. On June 2, 1935, 5 days after the last injection, the temperature was 101° F., and pulse and respirations normal.

Recovery in 6 days.

On June 4 he was given a 0.3-gram injection of neoarsphenamine. Three hours later a severe chill developed. Temperature was 103.8° F., with symptoms similar to those on first admission. He received 1 gram of sodium thiosulphate intravenously and symptoms were relieved in a few hours.

Recovery in 4 days.

(59—1935.) A patient who was infected April 1932 developed a sore on the shaft of the penis which was positive for *Treponema pallidum*. Repeated Kahn blood tests were negative.

From May 2, 1932, to September 22, 1933, he received 30 injections of neoarsphenamine (total amount not stated), 57 injections of bismuth salicylate, and an unstated amount of mercury inunctions.

From February 15 to May 17, 1935, he received 15 injections of mercury succinimide for a total of 3 grains.

On May 22, 1935, the fourth course of arsenical treatment began with a 0.3-gram injection of neoarsphenamine, followed by 0.3 gram on May 29, 0.45 gram on June 5, 0.6-gram injections on June 12 and 19. The patient was nauseated following injections administered on June 5, 12, and 19. Twenty minutes after the last injection he complained of chills. Temperature 101° F. and pulse 76.

BLOOD

Date	White blood count	Band forms	Segmented	Lymphocytes	Mono-cytes	Eosino-philes
June 20, 1935.....	2,400	11	57	20	6	6
June 21, 1935.....	3,200	5	58	31	4	2
June 22, 1935.....	3,250	6	39	42	11	2
June 27, 1935.....	3,800	5	53	37	3	2
June 29, 1935.....	4,200	6	60	23	10	1
July 11, 1935.....	5,200	4	57	33	4	2

Recovery in 10 days.

(60, 61, 62—1935.) This patient experienced three mild reactions during the third course of arsenical treatment. He was given a diagnosis of syphilis because of a penile lesion, general adenopathy, and repeated 4-plus Kahn blood tests.

From September 8, 1933, to January 17, 1934, he received 26 injections of neoarsphenamine (total amount not stated), 7 injections of bismosol, 8 injections of bismoid, and 5 injections of bismuth salicylate.

On June 29, 1935, he received a 0.3-gram injection of neoarsphenamine. Two minutes after the injection he had the appearance of a strangled individual, with choking and gagging which caused acute retching and vomiting. This was followed by chills and a temperature of 103° F. He was given 10 minims of adrenalin hypodermically. Recovery in 2 days.

On July 6, 1935, the patient was given a 0.03-gram injection of neoarsphenamine, and 45 minutes later a 0.27-gram injection. Two minutes after the last injection he developed symptoms similar to those following the first reaction. He was given 10 minims of adrenalin hypodermically. Recovery in 2 days.

On January 15, 1935, he was given a 0.3-gram injection of neoarsphenamine and 2 minutes later he developed the same symptoms as

in the two previous reactions. He was given 10 minims of adrenalin hypodermically. Recovery in 2 days.

(63—1935.) A patient, infected June 21, 1935, developed a lesion on the shaft of the penis, which was positive for *Treponema pallidum*, and marked inguinal adenopathy.

Arsenical treatment was started on June 23, 1935, with a 0.03-gram injection of neoarsphenamine, followed in 45 minutes by a 0.27-gram injection. Several hours after the last injection the patient developed a severe headache and chills. Temperature, 101° F. He received 10 minims of adrenalin hypodermically. Recovery within 24 hours.

On June 29 he was given a 0.03-gram injection of neoarsphenamine, followed in 45 minutes by a 0.27-gram injection. No reaction.

(64—1935.) The source of infection in this case is unknown, but it is believed that the disease existed for several years. The patient was given a diagnosis of syphilis because of clinical and serological findings.

He received one course of arsenical treatment in 1933 (type and amount not stated). The second course of arsenical treatment was instituted on June 27, 1935, with a 0.4-gram injection of neoarsphenamine, followed by 0.45 gram on July 3 and 0.6 gram on July 11, 1935. As concurrent treatment he was given five injections of bismuth salicylate.

Five minutes after the last injection of neoarsphenamine the patient became acutely ill with severe chills of about 10 minutes' duration; pulse was 136 and thready; respirations 24 and shallow; and face and neck were flushed. One hour later, following an enema, he became nauseated and vomited. He received 10 minims of adrenalin hypodermically. Recovery within 24 hours.

(65—1935.) This patient was given a diagnosis of syphilis because of a typical chancre on the shaft of the penis which was positive for *Treponema pallidum*.

From March 29 to May 8, 1935, he received 9 injections of neoarsphenamine, for a total of 4.3 grams, and 10 injections of bismuth. The second course of arsenical treatment was started on August 7, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.5-gram injections on August 14 and 21. Immediately after the last injection the patient felt dizzy, became nauseated, and vomited. Chills and headache followed. Temperature was 98.6° F.; pulse, 72; and respirations, 16. He received 1 gram of sodium thiosulphate intravenously after which he felt better but continued to vomit. Recovery within 24 hours.

The patient was given a 0.2-gram injection of arsphenamine in 100 cubic centimeters of 5 percent glucose solution on August 27, 1935, 0.2 gram on September 5, 0.3 gram on September 12, 0.35 gram on September 19, and 0.4-gram injections on September 26 and October 3, without signs of reaction.

(66—1935.) This patient, who was exposed on December 26, 1931, was given a diagnosis of syphilis on January 25, 1932, because of secondary lesions and a 4-plus Kahn blood test.

From January 26 to September 27, 1932, he received 22 injections of neoarsphenamine (total amount not stated), 30 injections of bismuth, and 2 injections of bismosol.

The fourth course of arsenical treatment was begun on August 8, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.5 gram August 31.

Immediately after the last injection the patient became nauseated and vomited. He received 1 cubic centimeter of adrenalin hypodermically. One hour later again became nauseated and complained of chills and pain in the abdomen and muscles of the legs. All symptoms disappeared within 6 hours.

(67—1935.) A patient who was infected October 23, 1933, developed multiple chancres on the penis which were positive for *Treponema pallidum*. A Kahn blood test was 3-plus.

November 24, 1933 to March 14, 1935, he received 14.2 grams of neoarsphenamine, 5 injections of thiobismol, 28 injections of bismuth, and 12 injections of mercury succinimide.

August 8, 1935 the fifth course of arsenical treatment began with a 0.45-gram injection of neoarsphenamine, followed by 0.6 gram August 15 and 22, 1935. He was also given three injections of bismosol as concurrent treatment.

Twenty-five minutes after the last injection of neoarsphenamine, the patient developed a severe headache, feeling of fullness in his head and ears, burning of the eyes, and redness of the skin and sore throat. The temperature was 96.8° F.; pulse, 104; and respirations, 22. He received 1 gram of sodium thiosulphate intravenously. Recovery within 45 minutes.

(68, 69—1935.) This patient experienced two mild reactions during his first course of arsenical treatment.

The source of infection is unknown. He was admitted to the sick list July 24, 1935 with tonsillitis, acute. Examination revealed: An ulcer on the right tonsil, suggestive of primary luetic infection; generalized adenopathy; a macular, spotty rash over the chest and abdomen; and a 4-plus Kahn blood test.

Antiluetic treatment was started on August 1, 1935 with 2 grains of bismuth salicylate intramuscularly, followed by 2 grains August 6 and 9, respectively. On August 13 he received a 0.3-gram injection of neoarsphenamine and 5 hours after the injection became chilly, and experienced a rise in temperature to 103° F. His condition was considered to be general toxemia from destruction of treponemata and not due to drug sensitivity. Recovery in 4 days.

On August 20 he received a 0.3-gram injection of neoarsphenamine, without evidence of reaction.

On August 27 he received 0.6-gram injection of neoarsphenamine, and 5 minutes after the injection became chilly and recorded a temperature of 104° F., followed by slight headache and malaise. He was given 1 gram of sodium thiosulphate intravenously. Recovery in 2 days.

A 0.3-gram injection of neoarsphenamine was given on September 3 without evidence of further reaction.

(70—1935.) A patient, in whom the diagnosis of syphilis was established on June 6, 1929, received 12 injections of neoarsphenamine, 16 injections of bismosol, and 28 injections of mercury succinimide, between that date and September 22, 1932.

He received a 0.2-gram injection of neoarsphenamine July 9, 1935, and a 0.4-gram injection on July 16. A chill and a temperature of 102° F. developed 3 hours after the last injection, the temperature rising to 104° F. 1 hour later. Recovery in 9 hours.

(71—1935.) After exposure on May 10, 1935, this patient developed a penile lesion which was positive for *Treponema pallidum* on June 25, 1935. A Kahn blood test was 4 plus on July 1, 1935.

Arsenical treatment was started on June 25, and eight injections of neoarsphenamine for a total of 4.35 grams were given between that date and August 13. From August 15 to September 30 he was given 10 injections of bismosol.

The second course of arsenical treatment was begun on October 8 with a 0.3-gram injection of neoarsphenamine, followed by 0.6 gram on October 22. Forty minutes after the last injection a severe chill developed and a temperature of 103.4° F. was recorded.

The patient states that he had a slight chill following the first injection of neoarsphenamine on October 8, 1935, and a severe chill following the second injection on October 15, which he did not report. Recovery in 24 hours.

(72—1935.) A patient was exposed December 20, 1931. He developed a lesion on the shaft of the penis and a dusky red macular rash over the trunk on March 2, 1932. Repeated Kahn blood tests were 4 plus.

From March 10, 1932, to July 25, 1935, he received 64 injections of neoarsphenamine for a total of 39.8 grams, and 114 intramuscular injections of bismuth.

The eighth course of arsenical treatment was started August 1, 1935, with a 0.6-gram injection of neoarsphenamine, followed by 0.6-gram injections on August 8, 15, and 22. One minute after the last injection the patient developed nausea, flushed skin, a temperature of 99.8° F., and pulse 86. He was given 1 gram of sodium

thiosulphate intravenously after which he broke out in a profuse sweat. Recovery in 48 hours.

(73-1935.) This patient was infected on August 10, 1935, and developed a lesion on the penis and general inguinal adenopathy. A Kahn blood test was 4 plus on August 20, 1935.

He began treatment September 11, 1935, with a 0.3-gram injection of neoarsphenamine, and received 0.45-gram injections on September 18 and 25. Fifteen minutes after the last injection the patient developed a severe headache, general malaise, a temperature of 102.6° F., pulse 90, and respirations 20. Five hours after he received 1 gram of sodium thiosulphate intravenously temperature was 103° F. and pulse 98. He continued to complain of headache and generalized body pains. He was given one-half grain of codeine sulphate by mouth at 7 p. m. and at 9 p. m.

The following morning the patient felt comfortable. He was given 1 gram of sodium thiosulphate intravenously. Recovery in 2 days.

(74, 75, 76, 77, 78, 79, 80, 81, 82, 83-1935.) On October 31, 1935, 10 men on the same ship experienced mild reactions. The cause was undetermined. Twelve other men received arsenical treatment the same morning without ill effect, and 117 injections of neoarsphenamine from the same lot number had been previously administered during the month of October without reaction.

Four of the men received 0.45-gram injections and six received 0.6-gram injections of neoarsphenamine. Listed below are the total number of injections of an arsenical compound, course, injection on last course, and dose causing reaction:

Case number	Total injections	Course	Injection, present course	Doses in grams
No. 1.....	14	Second.....	Second.....	0.45
No. 2.....	31	Fifth.....	Ninth.....	.45
No. 3.....	25	Third.....	First.....	.45
No. 4.....	4	First.....	Fourth.....	.45
No. 5.....	44	Fourth.....	Ninth.....	.6
No. 6.....	20	Third.....	Sixth.....	.6
No. 7.....	21	do.....	Fourth.....	.6
No. 8.....	32	Fifth.....	Second.....	.6
No. 9.....	3	First.....	Third.....	.6
No. 10.....	14	Second.....	Fourth.....	.6

Six of the ten cases were given a diagnosis of syphilis because penile sores were positive for *Treponema pallidum*. Two cases developed a secondary syphilitic rash, and one case developed a mixed infection with generalized adenopathy and a positive Kahn blood test.

Case number 8 was considered a reinfection. The patient was first infected in 1932, and received four courses of arsenicals. After reinfection in 1935 he received two injections on his fifth course of arsenical treatment.

The dilution of six of the injections was 0.6 gram in 20 cubic centimeters of sterile distilled water and of four of the injections was 0.45

gram in 20 cubic centimeters of sterile distilled water. The rate of injection in two cases was 2 minutes, in seven cases 2½ minutes, and in one case 3½ minutes.

The onset of symptoms varied from 30 to 85 minutes after injection of neoarsphenamine. Symptoms were as follows:

Severe headache.....	10
Temperature: from 99.6° F. to 103° F.....	10
Conjunctivæ and pharynx injected.....	10
General malaise.....	7
Nausea and vomiting.....	5
Chills.....	4
Nausea.....	1

Treatment administered:

Sodium thiosulphate, 1 gram intravenously.....	6
Aspirin, grains 10, given at 1 p. m. and 6 p. m.....	8
Codeine sulphate, one-half grain, by mouth.....	3

Urinalysis was reported negative in eight cases, 1-plus albumin in one case, and a faint trace of albumin in one case. White blood count varied from 6,800 to 12,350. Three were reported over 11,000; three over 9,000; two over 7,000; one, 6,800; and one, 12,350.

Complete recovery occurred in 24 hours in eight cases and 48 hours in two cases.

Samples of the neoarsphenamine from the same lot number and a sample of the water used were forwarded to the Bureau of Medicine and Surgery for analysis. These samples passed satisfactory tests at the National Institute of Health, United States Public Health Service.

(84—1935.) This patient was given a diagnosis of syphilis December 1, 1932, because of three small indurated penile ulcers, general adenopathy, and a 4-plus Kahn blood test.

From December 5, 1932, to July 16, 1935, he received 62 injections of neoarsphenamine (total amount not stated), 36 injections of bismosol, and 76 injections of mercury.

On September 24, 1935, the eighth course of arsenical treatment began with a 0.3-gram injection of neoarsphenamine, followed by 0.45-gram on October 15 and 0.6-gram injections on October 22 and November 5. He also received two injections of bismosol.

Immediately after the last injection of neoarsphenamine the patient's symptoms were headache, chills, nausea, vomiting, flushed face, and injected conjunctivæ. Temperature 100 and pulse 110.

The patient stated that he was nauseated after each of the injections of this course of arsenical treatment.

Recovery in 5½ hours.

(85—1935.) The source of infection in this case is unknown. The patient complained of "feeling bad." Examination revealed a secondary syphilitic rash over the body and a 2-plus Kahn blood test.

Arsenical treatment was begun December 4, 1935, with a 0.45-gram injection of neoarsphenamine. Eleven hours after the injection the patient became nauseated and vomited and experienced a stiff neck and generalized aching. Temperature, 103° F.; pulse, 104; and respirations, 28.

He received two intravenous injections of sodium thiosulphate, 1 gram each, on December 5, and 1 gram on December 6.

Recovery in 5 days.

(86—1935.) A patient, whose diagnosis of syphilis was established March 3, 1933, received treatment as follows:

December 7, 1932, to February 24, 1933—Six injections of bismuth salicylate.
March 8 to March 24, 1933—Eight injections of bichloride of mercury and an unstated amount of potassium iodide.

May 4 to May 25, 1933—Six injections of mercury succinimide.

July 20 to September 4, 1933—Seven injections of bismosol.

January 22 to March 22, 1934—Specific mixture (amount not stated).

April 10 to May 29, 1934—Seven injections of bismosol.

August 21 to September 4, 1934—Three injections of tryparsamide, and four injections of bismosol.

September 9 to September 13, 1934—One injection of bismuth salicylate.

October 11 to December 4, 1934—Seven injections of bismosol.

January 1 to May 1, 1935—Potassium iodide in ascending, drop doses.

On November 6, 1935, the patient received a 0.3-gram injection of neoarsphenamine, followed by 0.45 gram on November 13, and 0.6 gram on November 20. One and one-half hours after the last injection he developed a headache, generalized aching, and a tired feeling and 6 hours later he reported to the sick bay complaining of chills and fever. Examination revealed flushed face, slightly edematous eyes, congested conjunctivae, congested nasal mucosa, slightly swollen lips, and injected and edematous pharynx. Temperature was 102.2° F. pulse, 120; and respirations, 30. Blood count: Erythrocytes, 3,730,000; leukocytes, 5,350; hemoglobin, 80 percent; polymorphonuclears, 74; segmented, 68; band forms, 5; lymphocytes, 19; monocytes, 6; juveniles, 1; eosinophiles, 1. He received 1 gram of sodium thiosulphate intravenously at 6 p. m., 1 gram of sodium thiosulphate by mouth at 8 p. m., and three-eighths grain of ephedrine hydrochloride by mouth at 10 p. m.

November 21. The patient has practically recovered. Temperature is 99.2° F.; pulse, 80; and respirations, 20. Still complaining of slight headache. Urine negative except for few squamous epithelial cells and few pus cells. Dickens' test positive. Blood count: Leukocytes 5,700; polymorphonuclears 77; segmented 72; band forms 5; lymphocytes 16; monocytes 7. Temperature was 100.2° F. at night.

November 22. The patient complains of slight headache and tired feeling. He received three-eighths grain of ephedrine hydrochloride by mouth at 8 a. m., 1 p. m., and 6 p. m. Blood count: Leukocytes

4,675; polymorphonuclears 57; segmented 53; band forms 4; lymphocytes 32; monocytes 8; eosinophiles 3.

November 23. The patient continues to complain of slight headache and tired feeling. Temperature, 99° F.; pulse, 74; and respirations, 18. Blood count: Erythrocytes 3,870,000; leukocytes 3,850; hemoglobin 80 percent; polymorphonuclears 44; segmented 38; band forms 6; lymphocytes 45; monocytes 5; eosinophiles 6.

The patient's condition gradually improved. He remained on the sick list under observation until December 20, 1935, 30 days after onset of first symptoms.

BLOOD DYSCRASIAS

Sulpharsphenamine.—(90—1935.) This patient was given a diagnosis of syphilis May 22, 1934, because of a positive darkfield examination of an ulcer on the shaft of the penis and a 4-plus Kahn blood test.

From May 29 to September 26, 1934, he received nine injections of neoarsphenamine (total amount not stated) and five injections of thiobismol.

From October 2 to October 23, 1934, he received four injections of sulpharsphenamine for a total of 1.2 grams. As concurrent treatment he was given specific mixture 4 cubic centimeters three times daily. Following the fourth injection of sulpharsphenamine, the patient experienced a mild vasomotor phenomena reaction. Recovery in 7 days.

From November 6, 1934, to January 3, 1935, he received 15 injections of bismuth salicylate; January 8, 1935, a 0.1-gram injection of sulpharsphenamine; and on January 15 and 22, 0.2-gram injections of sulpharsphenamine. Fifteen minutes after the last injection the patient complained of a chilly feeling and dull headache. One hour later he had a rather severe chill followed by nausea and vomiting. Temperature, 102.4° F.; pulse, 92; and respirations, 20. One gram of sodium thiosulphate was administered intravenously.

January 23. The patient complains of a cold in his head and weakness. Lips are covered with herpes.

January 26. The herpes on his lips are healing and the cold in his head is apparently well.

Blood

Date	Red blood count	White blood count	Hemoglobin	Band forms	Segmented	Lymphocytes	Monocytes	Eosinophiles	Juveniles	Basophiles	Myelocytes
Jan. 22, 1935; 11:15 a. m.	4,810,000	1,700	90	20	41	26	8	2	2		1
1:20 p. m.		4,900		19	67	4		3			
4:30 p. m.		6,600		18	69	9	1	1	2		
Jan. 23, 1935		4,600		18	69	9	1	1	1		
Jan. 24, 1935	4,900,000	5,700	90	5	60	27	1	3		1	
Jan. 25, 1935		6,300		3	56	33	1	2		1	
Jan. 29, 1935		7,400		7	64	30	5	4			

His condition gradually improved and he returned to duty in 8 days.

Neoarsphenamine.—(87—1935.) A patient (female-supernumerary), who was infected in July 1933, was given a diagnosis of syphilis because of secondary rash and a positive blood reaction. From July 19, 1933, to October 14, 1934, she received three courses of neoarsphenamine for a total of 15.15 grams, 10 injections of bismarsen, and 20 injections of bismuth salicylate. From July 23 to August 30, 1934, she was given 10 injections of sodium thiosulphate intravenously (amount not stated).

On January 18, 1935, she began the fifth course of arsenical treatment with a 0.3-gram injection of neoarsphenamine, followed by a 0.45-gram injection January 25 and 0.6-gram injections on February 1 and 8, 1935.

Three hours after the last injection the patient developed a hemorrhage from the gums, and a few pin point petechial areas appeared about the upper extremities. She received 1 gram of sodium thiosulphate intravenously, 20 cubic centimeters of thromboplastin intramuscularly, 1,000 cubic centimeters of 5-percent glucose in normal saline intravenously, and 20 cubic centimeters of her own blood intramuscularly. Blood: Red blood count, 3,666,000; white blood count, 10,000; hemoglobin, 75 percent; blood platelets, 75,000.

Recovery in 3 days.

(88—1935.) This patient was infected July 18, 1934, developing a penile lesion which was positive for *Treponema pallidum* August 20, 1934.

From August 20, 1934, to September 13, 1935, he received 21 injections of neoarsphenamine, for a total of 9.45 grams, 20 injections of bismosol, and 9 injections of bismuth. On November 8, 1935, he was given a 0.45-gram injection of neoarsphenamine, followed by 0.45-gram injections on November 12, 15, and 19.

Twenty-four hours after the last injection the patient reported several small purple spots on his skin. Examination showed several petechial areas in the mucous membrane of the mouth and anterior tonsillar pillars, with some bleeding around one of the lower incisor teeth. There were also several purpuric areas over the body, the largest of which were on the lower extremities. None of these areas were painful to palpation. No other symptoms.

Blood

Date	Red blood count	White blood count	Hemoglobin	Band forms	Segmented	Lymphocytes	Mono-cytes	Eosino-philies	Blood platelets
Nov. 20, 1935.....	4,870,000	9,000	95	8	58	25	8	1	20,000
Nov. 21, 1935.....	5,050,000	13,300	85	-----	-----	16	3	2	80,000
Nov. 25, 1935.....	-----	-----	-----	-----	-----	-----	-----	-----	289,000
Nov. 27, 1935.....	4,600,000	-----	-----	-----	-----	-----	-----	-----	289,000
Nov. 29, 1935.....	4,420,000	-----	-----	-----	-----	-----	-----	-----	350,000
Dec. 7, 1935.....	4,860,000	9,200	90	14	38	40	8	-----	323,940
Dec. 12, 1935.....	4,820,000	9,200	-----	32	48	18	-----	-----	-----

The lesions over the body and extremities continued to appear until November 21, 1935, and began to clear up on November 25.

Recovery in 27 days.

(89—1935.) This patient was given a diagnosis of syphilis on August 19, 1918, because of clinical and serological findings. During the year 1918 he received 3 injections of salvarsan and 20 injections of mercury.

From July 2, 1932, to April 17, 1933, he received 22 injections of neoarsphenamine and 20 injections of bismuth salicylate.

From February 13 to June 19, 1935, he received 9 injections of neoarsphenamine and 18 injections of bismosol.

On June 26, 1935, he received a 0.3-gram injection of neoarsphenamine, followed by 0.5-gram July 3, 0.3-gram July 31, and 0.5-gram injections August 7 and 14.

Five days after the last injection the patient complained of sore throat, and examination showed the throat markedly inflamed and swollen, with small ulcerations on right tonsil. Temperature, 103° F.; pulse, 90; and respirations, 20. Examination otherwise essentially negative.

On August 21, 1935, the patient developed a marked swelling and redness of the entire pharynx, with areas of patchy exudate on the tonsils and anterior pillars. Temperature was 104° F.; pulse, 112; and respirations, 24. He was given one injection of leukocytic extract and daily injections of 10 cubic centimeters of pent-neucleotide and liver extract representing 300 grams of liver daily for 3 days.

Blood

Date	Red blood count	White blood count	Hemoglobin	Band forms	Segmented	Lymphocytes	Basophiles	Monocytes	Eosinophiles	Myelocytes	Juveniles	Premyelocytes	Türk's cells
Aug. 21, 1935.....	3,060,000	1,800	70	-----	2	50	---	2	2	38	4	---	---
Aug. 22, 1935.....	2,800	2,800	---	6	---	19	1	8	7	28	28	2	2
Aug. 23, 1935.....	4,200,000	5,650	91	34	10	18	1	4	3	9	20	1	---
Aug. 24, 1935.....	4,300,000	7,200	8	30	14	32	---	4	2	2	16	---	---
Aug. 27, 1935.....	4,390,000	9,200	85	20	38	28	---	6	---	2	6	---	---
Aug. 28, 1935.....	4,300,000	7,400	80	31	21	32	3	4	---	3	6	---	---
Aug. 30, 1935.....	4,640,000	7,600	80	9	34	46	---	4	---	2	5	---	---

NOTE.—Aug. 21, 1935: Blood platelets, 330,480; Aug. 22, 1935: Lymphoblast, 1; Aug. 23, 1935: Blast cells, 2.

Recovery in 14 days.

(91—1935.) This patient (supernumerary-Peruvian Navy) was infected in March 1935, developing a sore on his penis which was positive for *Treponema pallidum* April 11, 1935.

Arsenical treatment began April 11, 1935, with a 0.3-gram injection of neoarsphenamine, followed by a 0.4-gram injection April 14, and a 0.6-gram injection April 18. Nausea and vomiting developed 5 hours after the last injection. The following day the patient complained of fever, headache, malaise, and sore throat. Blood count: Leukocytes, 7,400; neutrophiles—mature, 60, immature, 4; eosinophiles, 1; lymphocytes, 25. Urinalysis showed a trace of albumin and a small amount of mucus.

April 21. Blood count: Leukocytes, 6,400; neutrophils—mature, 58, immature, 8; eosinophiles, 2; lymphocytes, 32.

April 22. The patient is passing frank blood with clots; the throat is markedly injected with small petechiae on buccal mucous membrane; a generalized scarlatiniform rash is evident. Urinalysis shows 4-plus albumin. Two injections of sodium thiosulphate, 1 gram each, were administered intravenously.

April 24. The rash is fading and the redness of the throat is subsiding. He received two intravenous injections of sodium thiosulphate, 1 gram each, on April 23 and April 24.

His condition gradually improved and he was returned to duty in 10 days.

(92—1935.) The source of infection in this case is unknown. The patient was given a diagnosis of syphilis because of moderate general adenopathy, rash on body, falling of hair in spots, 4-plus Kahn blood test, and a small scar on the penis.

From October 1 to December 20, 1934, he received 10 injections of neoarsphenamine for a total of 4.35 grams and 10 injections of bismosol.

On January 14, 1935, he received a 0.3-gram injection of neoarsphenamine, followed by a 0.45-gram injection January 28. As concurrent treatment two injections of bismosol were given. Six and one-half hours after the last injection of neoarsphenamine the patient reported complaining of spots on the legs and bleeding of the gums. Numerous petechial spots developed on his arms, chest, ankles, and feet. The left eye was swollen and marked ecchymosis present, with slight subconjunctival hemorrhage. The throat and mouth had injected appearance. Red blood count, 4,410,000; white blood count, 5,600; band forms, 8; segmented, 67; lymphocytes, 24; eosinophiles, 1.

January 29. Blood: Hemoglobin, 85 percent; juvenile, 1; band forms, 7; segmented, 53; lymphocytes, 35; monocytes, 2; eosinophiles, 2; blood platelets, 110,000. Urinalysis negative and Dickens' test negative.

January 30. Red blood count, 4,430,000; white blood count, 6,200; hemoglobin, 85 percent; band forms, 5; segmented, 59; lymphocytes, 28; monocytes, 4; eosinophiles, 3; basophiles, 1; blood platelets, 110,750.

February 4. Red blood count, 4,420,000; white blood count, 6,300; hemoglobin, 85 percent; band forms, 5; segmented, 56; lymphocytes, 34; monocytes, 2; eosinophiles, 3; blood platelets, 161,400.

Treatment.—One-gram injections of sodium thiosulphate were administered intravenously on January 28, 29, and 30.

Recovery in 8 days.

(93—1935.) A patient, who was infected September 14, 1934, developed a typical penile lesion which was positive for *Treponema pallidum*. Repeated Kahn blood tests were 4 plus.

From October 24 to November 27, 1934, he received 6 injections of neoarsphenamine for a total of 3.2 grams; from December 13, 1934, to February 14, 1935, 10 injections of sulpharsphenamine for a total of 3.2 grams; and as concurrent treatment, 6 injections of bismuth salicylate and 1 dram of mixed treatment three times daily for 8 days.

He received a 0.45-gram injection of neoarsphenamine on May 24, 1935, and 0.6-gram injections on May 31, June 7, and 14. Two hours after the last injection the patient developed bleeding from his nose and gums and numerous petechial hemorrhages over lower extremities, shoulders, and back. The bleeding from the gums continued for 2 days, and from the nose for 9 days. Packing was required at intervals. On June 23 all external bleeding ceased and the petechial hemorrhages gradually faded.

Blood

Date	Red blood count	White blood count	Hemoglobin	Band forms	Mature	Young	Lymphocytes	Eosinophiles	Mono-cytes	Baso-philis	Blood plate-lets
<i>1935</i>											
June 14.....	3,750,000	10,000	80	12	64	-----	24	-----	-----	-----	190,000
June 15.....	4,300,000	8,200	75	11	58	4	20	6	-----	1	105,000
June 18.....	3,340,000	7,000	80	9	58	-----	29	3	1	-----	47,000
June 21.....	3,000,000	7,000	75	8	58	-----	23	6	4	-----	48,000
June 24.....	3,000,000	7,200	70	2	66	-----	28	-----	4	-----	43,050
June 26.....	3,300,000	6,400	75	11	60	2	24	3	-----	-----	39,600
June 28.....	3,670,000	5,400	75	8	48	4	28	4	8	-----	80,700
July 10.....	3,900,000	6,300	80	-----	-----	-----	-----	-----	-----	-----	117,000
July 17.....	4,000,000	6,800	85	-----	-----	-----	-----	-----	-----	-----	140,000
July 24.....	4,160,000	8,200	85	-----	-----	-----	-----	-----	-----	-----	160,000
July 31.....	4,550,000	5,400	85	6	40	7	38	2	6	1	270,000

Treatment.—The patient received 1 gram of sodium thiosulphate intravenously twice daily for six doses; calcium lactate, grains 10, every 4 hours for 6 days; dicalcium phosphate, grains 15, every 4 hours for 5 days; graduated heliotherapy for 1 month; and liver (whole), 250 grams, added to his diet daily for 1 month.

Recovery in 29 days.

(94—1935.) A patient was infected in November 1933 and developed an indurated ulcer on the prepuce of his penis which was positive for *Treponema pallidum*.

From December 28, 1933 to July 2, 1934, he received 32 injections of neoarsphenamine for a total of 13.2 grams and 27 injections of bismosol and from September 4 to November 27, 1934, he received 13 injections of bismosol.

On December 3, 1934, the third course of arsenical treatment was begun with a 0.25-gram injection of neoarsphenamine, followed by 0.45-gram injections on December 10, 17, 24, and 31, 1934, January 7, 14, and 21, 1935. Two days after the last injection the patient developed numerous hemorrhages into the skin of the body, neck, and extremities, and from the mucous membranes of the mouth. Physical examination was otherwise essentially negative.

January 28. The patient's condition is somewhat improved. He has numerous purpuric spots over his entire body and the blood is now oozing from the nose and gums.

Blood

Date	Red blood count	White blood count	Hemoglobin	Band forms	Segmented	Lymphocytes	Monocytes	Eosinophiles	Juveniles	Blood platelets	Coagulation time
<i>1935</i>											
Jan. 25.....	4,740,000	9,250	-----	12	64	16	2	5	1	37,920	10 min. and 30 seconds.
Jan. 26.....	4,500,000	8,950	85	10	68	16	2	4	-----	40,500	10 minutes.
Jan. 27.....	4,750,000	11,450	90	17	54	24	1	1	3	42,950	4 min. and 45 seconds.
Jan. 29 ¹	5,040,000	10,650	100	7	63	17	13	-----	-----	-----	3 minutes.
Jan. 30 ²	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----
Feb. 26.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	15,600	-----
Mar. 4.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	18,000	-----
Mar. 7.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	120,000	-----
Mar. 18.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	116,750	-----

¹ There were no blood platelets noted in first 1,000 cells counted.

² Reticulocyte count 0.9.

NOTE.—From Feb. 1 to 16 frequent blood studies disclosed less than 10,000 platelets.

Treatment.—The patient received 3 blood transfusions of 300 cubic centimeters each, on January 29, January 31, and February 11, 1935, and 6 intramuscular injections of whole blood in 10-cubic-centimeter doses, the last injection being given on March 5.

The patient returned to duty March 19, 1935 in excellent physical condition. No evidence of purpuric spots and during the following month no evidence of bleeding.

Recovery in 55 days.

(95—1935.) A patient, who was infected on October 4, 1934, developed several indurated ulcers on the frenum of the penis and slight inguinal adenopathy on October 18. On October 19 a dark-field examination was positive for *Treponema pallidum*; Kahn blood tests were negative on October 22, 4 plus on October 29, and 4 plus on November 5, 1934.

From October 19 to November 13, 1934, he received 2.1 grams of neoarsphenamine or an average of 84 milligrams per day; on December 5, 1934, one injection of neoarsphenamine (amount not stated); from December 21, 1934 to January 29, 1935, 7 injections of neoarsphenamine, a total of 4.05 grams, or an average of 104 milligrams per day; and, as concurrent treatment, 10 injections of bismuth, 2 cubic centimeters each, between the dates of October 19, 1934, and January 17, 1935.

On February 2, 1935, 4 days after the last injection of neoarsphenamine, he felt weak and "dopey" but continued his duties until February 4, when he reported to the sick bay complaining of a pain across his lower back. He was admitted to the sick list with diagnosis undetermined (influenza). Patient seemed acutely ill and some-

what depressed. Temperature, 102.2° F.; pulse, 74; respirations, 20. White blood count, 3,200; band forms, 4; segmented, 46; lymphocytes 42; monocytes 8. Evening temperature 104.6° F. and pulse 92.

February 5. No improvement. Moderate general adenopathy. Tiny yellowish granular eruption over soft palate and pillars. Temperature 104° F. and 101° F. General weakness and backache. Three moderate nosebleeds. Urine shows 6 plus albumin. White blood count, 3,600.

February 6. No improvement. Moderate epistaxis. Increased adenopathy. Temperature 103.8° F., pulse 102. Red blood count, 3,330,000; white blood count, 3,500; hemoglobin, 70 percent; differential; band forms, 8; segmented, 56; lymphocytes, 27; monocytes 9; Turk's irritation forms, 5. Weil-Felix: negative in all dilutions. This man has been undergoing antiluetic treatment for several months but no reaction has been encountered except a mild one following the first injection of neoarsphenamine.

The patient was admitted to a naval hospital on February 6, 1935, complaining of pain in his back and weakness. He appeared to be acutely ill and exhausted. Temperature, 103.2° F.; pulse, 100; and respirations, 22. Profuse sweating. Skin and sclera clear. A general moderate adenopathy, more marked in anterior cervicals and inguinals. Both epitrochlears palpable. Throat injected. Soft palate and buccal surface of mouth have what appears to be small pustules studding the surfaces. Nares crusted with dried blood. Chest, lungs, and heart negative. Abdomen negative except a marked increase of liver dullness. Red blood count, 4,150,000; hemoglobin, 80 percent; white blood count, 4,850; band forms, 2; segmented, 52; lymphocytes, 40; monocytes, 6. Urine negative except for considerable albumin.

February 7. Temperature, 100–102° F.; pulse, 102–120. Some of the throat lesions have ulcerated, involving almost the entire uvula. Very fetid odor to breath. Smears from ulcers show a great variety of organisms, including a few Vincent's Angina. White blood count, 7,350; juveniles, 15; band forms, 38; segmented, 18; basophiles, 1; lymphocytes, 23; monocytes, 5. Chest is clear. Skin is clear. Slight epistaxis. Extremely exhausted. Diagnosis changed to agranulocytosis.

February 8. Liquid nourishment. Experienced a moderately severe nosebleed which required light packing to control. White blood count, 6,200; hemoglobin, 80 percent; juveniles, 16; band forms, 19; segmented, 19; myelocytes, 1; lymphocytes, 24; Turk's irritation forms, 21. Temperature, 101° F.; pulse, 140; and respirations, 25–30. There are few moist râles over left chest.

February 9. Glands in neck and inguinal region seem slightly larger. Temperature, pulse, and respirations remain the same. It is difficult to examine patient but left base of chest seems to be

somewhat dull to percussion and vocal fremitus has increased. Urine: Color amber; slightly positive for bile; specific gravity, 1.020; albumin, positive; sugar, negative; no blood or casts; few leukocytes. Red blood count, 3,860,000; white blood count, 9,350; hemoglobin, 75 percent; juveniles, 8; band forms, 12; segmented, 40; lymphocytes, 18; monocytes, 1; myelocytes, 1; Turk's forms, 20. Ulcerations of mouth worse. X-ray examination of chest shows a slight increase in density in the upper half of the left-lung field. The right hilum seems more prominent than normal with no definite pneumonic areas noted.

February 10. Quite restless, semidelirious at times. Temperature taken by axilla, 100.5° F.; pulse, 130 to 140; and respirations, 30. Skin and sclerae icteric.

February 11. Died at 6:40 a. m., apparently from cardiac exhaustion.

Autopsy findings.—The body is that of a well-developed and fairly well-nourished white male, 26 years of age. Skin and sclerae have a moderate icteric tint. Pupils equal and in middilation. Rather marked post-mortem lividity in dependent portion of trunk. Superficial cervical and inguinal glands palpable; some about the size of lima beans. Epitrochlear glands palpable. Throat and mouth severely ulcerated. Y-shape necropsy incision. Very little subcutaneous fat. Muscles well developed, rather dark in color.

Chest: No excess of pleural fluid. Few old pleural adhesions left side.

Lungs: Pneumonic area, left base with marked passive congestion, and edema of remainder of left lung. Right lung shows some edema and moderate passive congestion; no areas of consolidation. Pericardial sac contained 100 cubic centimeters of clear straw-colored fluid.

Heart: Moderate concentric hypertrophy of left ventricle; valves and aorta lemon color. Mass of mediastinal glands, about the size of a fist, behind heart. Not matted, rather soft.

Liver: Greatly enlarged, weight 3,600 grams. Light yellow in color. On cut section, showed fatty infiltration and edema.

Gall bladder: Pale yellow in color, walls 1 centimeter thick, very edematous, and contains about 5 cubic centimeters of watery greenish-black fluid.

Spleen: Greatly enlarged, weight 750 grams. Mushy in consistency and dark red in color.

Kidneys: Large, pale, and edematous. Capsules stripped easily. Weights: Right, 335 grams; left, 287 grams. Left kidney showed a 1 by $\frac{1}{2}$ by $\frac{1}{2}$ cubic millimeter white infarct about center of greater curvature. Surfaces smooth; cortex swollen; yellowish in color.

Glands: Mesenteric and inguinal glands enlarged to about the size of lima beans. Pale in color and rather soft.

Bones: Bone marrow of sternum rather dark red in color. Marrow of right femur fatty and seemed to be softer than normal.

Summary: (1) Moderate jaundice. (2) General adenopathy. (3) Old left pleural adhesions. (4) Pneumonia, left lower lobe; passive congestion, upper lobe. (5) Edema and passive congestion, right lung. (6) Moderate hypertrophy of left ventricle of heart. (7) Hypertrophy and fatty infiltration of liver (toxic, history of neoarsphenamine). (8) Acute toxic passive congestion of spleen. (9) Subacute parenchymatous nephritis. (10) Ulceration, throat and mouth. Smears: left lung shows pneumococci. Cultures of post-mortem blood from heart show pneumococci. (Blood probably backed into heart from lungs, post mortem.)

GASTROINTESTINAL

Neoarsphenamine.—(96—1935.) The source of infection in this case is unknown. The patient was given a diagnosis of syphilis November 5, 1934, because of repeated 4-plus Kahn blood tests and palpable epitrochlear and inguinal glands.

Arsenical treatment began November 14, 1934, with a 0.3-gram injection of neoarsphenamine, followed by a 0.45 gram injection on November 21, 0.6-gram injections on December 4, 11, and 18, 1934, and January 15, 1935. As concurrent treatment, he was given 6 injections of bismuth salicylate. Four hours after the last injection of neoarsphenamine the patient complained of nausea and discomfort in his abdomen. Temperature, 103° F.; pulse, 90. Four hours later he vomited.

Recovery in 10½ hours.

The following week he received a 0.3-gram injection of neoarsphenamine without symptoms of another reaction.

Arsphenamine.—(97—1935.)—The source of infection in this case is unknown. The patient was given a diagnosis of syphilis because of constant sore throat, general adenopathy, secondary rash, and a 3-plus Kahn blood test.

From February 1, 1934, to January 3, 1935, he received 20 injections of neoarsphenamine, for a total of 9.9 grams, and 38 injections of bismuth salicylate.

On January 10, 1935, he received a 0.3-gram injection of neoarsphenamine; on January 17, a 0.3-gram injection of arsphenamine; and on January 24 and 31, 0.4-gram injections. Three hours after the last injection of arsphenamine the patient ate a sandwich, became nauseated, and vomited. He states he was nauseated after the two previous injections but did not report it.

Recovery in 4 hours.

On February 7, 14, and 21, 1935, he was given 0.4-gram injections of arsphenamine. He developed a macular arsenical dermatitis 2½ hours after the last injection. Recovery in 4 days. (Case 1—1935, Naval Medical Bulletin, October 1936.)

Neoarsphenamine.—(98—1935.) A patient, who was infected on January 5, 1933, developed an indurated ulcer on the shaft of the penis which was positive for *Treponema pallidum*.

From January 20, 1933, to February 4, 1934, he received 25 injections of neoarsphenamine (total amount not stated), 14 injections of bismosol, and 10 injections of mercury.

On January 10, 1935, his fifth course of arsenical treatment began with a 0.3-gram injection of neoarsphenamine, followed by 0.45-gram injections on January 17, 24, and 31. Immediately after the last injection he became nauseated and vomited, followed by headache, malaise, chills, and fever. Face was flushed, and conjunctivae injected.

All symptoms disappeared within 4 hours.

(99—1935.) This patient was given a 0.3-gram injection of neoarsphenamine on May 1, 1935, for treatment of severe eczema of the legs. Chills followed in 8 hours. Later he became nauseated and vomited. Temperature, 104° F.; pulse, 100; and respirations, 22. He was given 15 minims of adrenalin hypodermically, and 1 gram of sodium thiosulphate intravenously.

Three days after the injection of neoarsphenamine, nausea and vomiting ceased, and the temperature was normal.

Recovery in 8 days.

(100—1935.) A patient was infected November 6, 1934, and developed general adenopathy and a typical hard single lesion on his penis which was positive for *Treponema pallidum*. Repeated Kahn blood tests were positive.

From November 30, 1934, to May 7, 1935, he received 20 injections of neoarsphenamine for a total of 10.4 grams, and as concurrent treatment, 8 injections of bismuth salicylate, 20 injections of iodobismatol, and protoiodide of mercury one-third grain three times daily for 2 months.

On October 1, 1935, the third course of arsenical treatment was started with a 0.225-gram injection of neoarsphenamine, followed by a 0.357-gram injection on October 8, and a 0.225-gram injection on October 15. Fifteen minutes after this injection the patient vomited and complained of cramps in the abdomen and extremities. He had slight stiffness of the neck and a dull headache. Temperature was subnormal. He vomited 10 times during the day. White blood count, 14,700; polymorphonuclears, 95; and lymphocytes, 5. One gram of sodium thiosulphate was given intravenously.

October 16. Morning temperature was 99.6° F. but soon became normal. Patient stated that the ends of his fingers and the soles of his feet feel numb. He vomited three times during the day, the vomitus in one instance showing a slight tinge of bright red blood.

His condition gradually improved, and he was returned to duty in 8 days.

(101—1935.) This patient was infected in December 1934, developing a lesion on the prepuce of his penis which was positive for *Treponema pallidum*. A Kahn blood test was 3 plus.

Arsenical treatment was begun on February 24, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.6-gram injections on March 2, 9, 16, and 23, on which date he also received a 0.195-gram intramuscular injection of bismuth salicylate.

Two hours after the last injection of neoarsphenamine he complained of pain in his joints, a feeling of heaviness in his legs, and a severe frontal headache. Five hours after the injection he vomited and complained of intense headache. Temperature, 101° F.; pulse, 100; and respirations, 20. A 0.3-gram injection of sodium thiosulphate was administered intravenously. Repeated Dickens' tests were positive.

Recovery in 2 days.

LIVER DAMAGE

(102—1935.) This patient was infected February 12, 1935, developing a chancre on the dorsal corona of the penis which was positive for *Treponema pallidum*.

Arsenical treatment was instituted on February 19, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.45 gram on February 26, and 0.6 gram on March 5. Two hours after this injection the patient vomited and complained of malaise, flushing sensation, and headache. He stated that he felt feverish before he received the last injection of neoarsphenamine but did not report it at that time. Temperature, 100° F.; pulse, 90; and respirations, 20. He developed moderate injection of the conjunctivae, followed by nausea and vomiting. One gram of sodium thiosulphate was administered intravenously on March 5 and 6, and proctoclysis with 1,000 cubic centimeters of 5-percent glucose-saline on March 5.

March 8. Slight icteric tinge of the skin and mucous membranes. No apparent change in liver dullness. Urine very dark and negative. The jaundice deepened for 2 days and then cleared. Nausea and vomiting ceased, and the patient gradually improved.

Recovery in 13 days.

(103—1935.) A patient who was infected in December 1934 developed an indurated ulcer on the frenum of the penis which was positive for *Treponema pallidum*.

From January 8 to July 31, 1935, he received 10.2 grams of neoarsphenamine and 18 injections of bismosol; and on August 8 and 15, 2 injections of arsphenamine for a total of 0.8 gram.

On October 30, 1935, the fourth course of arsenical treatment was begun with a 0.3-gram injection of neoarsphenamine, followed by

0.35 gram on November 5, 0.4 gram on November 13, and 0.45 gram on November 20.

The patient stated that he felt nauseated, and dizzy within a few hours after the last injection but did not report the symptoms until November 25, 5 days after the injection. Examination at this time shows jaundice of the conjunctivae; Dickens' test, negative; red blood count, 5,400,000; and white blood count, 5,600.

November 29. General jaundice; icterus index, 57; bilirubinuria; a normal liver by X-ray; and impaired liver function by bromsulphalein test.

Treatment consisted of fat-free diet, saline catharsis, daily intravenous sodium thiosulphate (1 to 1½ grams) for a week, and non-surgical drainage of the gall bladder with the Rehfuess tube.

Recovery in 33 days.

(104—1935.) A patient, who was infected on January 1, 1935, developed an indurated ulcer on the penis which was positive for *Treponema pallidum*.

Arsenical treatment began January 24, 1935, with a 0.3-gram injection of neoarsphenamine, followed by 0.2 gram on January 29, 0.45 gram on February 2, and 0.6 gram on February 9. From January 25 to 31, 1935, he was given 1 gram of mercury ointment daily by inunctions.

Eight hours after the last injection of neoarsphenamine the patient complained of headache, abdominal pains, and itching of his skin. There was slight generalized icterus, injection of the sclera, flushed face, and slight tenderness over the liver. The urine was dark in color and positive for arsenic on Dickens' test. Examination otherwise negative. One gram of sodium thiosulphate was administered intravenously.

February 10. Improvement. The headache and pain in his abdomen have subsided. Red blood count, 3,700,000; white blood count, 7,500; hemoglobin, 85 percent; segmented, 50; lymphocytes, 32; band forms, 4; monocytes, 8; basophiles, 2; eosinophiles, 4. One gram of sodium thiosulphate was administered intravenously.

Recovery in 2 days.

ACUTE RENAL DAMAGE

(105—1935.) This patient was given a diagnosis of syphilis because of positive clinical and serological findings. Arsenical treatment was begun on August 15, 1933, 34 injections of neoarsphenamine, for a total of 20.4 grams, and 50 injections of bismuth salicylate being given between that date and October 18, 1934.

On February 14, 1935, the fourth course of arsenical treatment was started with a 0.3-gram injection of neoarsphenamine, followed by 0.6-gram injections on February 21 and 28. Three hours after the last

injection the patient complained of blurred vision. A physical examination at this time was negative. After several hours the patient felt much better and returned to duty.

On March 1, 1935, he stated that his vision was worse. Examination showed slight swelling under his eyes and the pupils reacted sluggishly.

Urine showed marked 4-plus albumin. Eye ground examination was negative. Several hours later the swelling under the eyes subsided and he stated that his vision had cleared.

March 4. The patient has no complaint. The urine continues to show 4-plus albumin. Red blood count, 4,550,000; white blood count, 12,950; hemoglobin, 85 percent; segmented, 72; lymphocytes, 26; eosinophiles, 2.

March 12. The patient has been symptom-free for several days. He was given 0.1 gram of sulpharsphenamine intramuscularly. Six hours later his vision became dimmed and blurred, but he made no report of this until 13 hours after the injection, at which time a physical examination was negative. White blood count, 8,200; hemoglobin, 90 percent; segmented, 64; lymphocytes, 30, monocytes, 4; eosinophiles, 2.

March 13. Vision normal. Urine continues to show 4-plus albumin.

March 21. The patient feels well. Urine has been normal for 3 days. He received 0.1 gram of sulpharsphenamine intramuscularly. Seven and one-half hours later he complained of blurred vision. Eye examination: V. O. D. 20/200; Jaeger number 1 at 13 inches. V. O. S. 20/100; Jaeger number 1 at 13 inches. Eye grounds are normal and there is no evidence in either eye of a spasm of the retinal vessels. With minus one sphere before each eye he reads 20/15 vision, Jaeger number 1 in each eye. The urine shows 3-plus albumin.

March 22. The patient stated that his vision was normal. The urine shows 4-plus albumin.

April 2. The patient has felt well for the past few days. Urine has been normal since March 29. Headache, a slight chill, and weakness developed 2 hours after he was given 0.1 gram of sulpharsphenamine intramuscularly. Temperature, 100.2° F.; pulse, 100; and respirations, 20. Symptoms subsided within 4 hours at which time he complained of blurred vision. Eye examination: V. O. D. and V. O. S. 20/100, Jaeger number 1. Pupils are dilated equally and in a moderately bright light were 6 millimeters in diameter. Both eyes react to light and accommodations, and consensual reflexes were present. Tension (McLean's tenometer) O. D. 48, O. S. 48. Refraction: Homatropine and cocaine. Retinoscope examination: Right eye—plus 0.25 vertically, plus 1.25 horizontally; left eye—plus 0.25 vertically plus 1.00 horizontally. Cycloplegic acceptance; V. O. D. 20/100; 1.00 ax. 15 equals 20/15 plus. V. O. S. 20/50—1; 0.25–0.75 ax. 15 equals 20/15 plus.

Eserine was used in each eye when the refraction was completed. His urine shows 3-plus albumin. The following table shows white blood count and differential count by hours during the day:

Blood

Time	White blood count	Seg-mented	Lympho-cytes	Band forms	Juven-iles	Baso-philes	Mono-cytes	Eosino-philes
11 a. m.-----	8,600	75	15	8	2			
1 p. m.-----	16,600	70	18	8	3	1		
3 p. m.-----	10,300	75	17	6	1			1
5 p. m.-----	9,200	67	23	5			3	2
7 p. m.-----	8,700	64	24	4		2	5	1

April 3. Eye examination: Tension (McLean's tenometer) (slight cycloplegia remained) O. D. 25, O. S. 27. Vision—O. D. 20/40—2; O. S. 20/20. The urine shows 3-plus albumin. White blood count, 7,400; band forms, 1; segmented, 49; lymphocytes, 36; eosinophiles, 7; monocytes, 7.

The patient's vision and urine gradually returned to normal after treatment with arsenical compounds was discontinued. He was discharged to duty after 50 days on the sick list, with recommendation that further treatment with arsenicals is contraindicated and that antisyphilitic treatment be continued with bismuth and mercury compounds.

VASCULAR DAMAGE

(106—1935.) A patient who was infected May 5, 1933, developed two indurated lesions on his penis, 3 days after exposure. A Kahn blood test was 4 plus on May 29, 1933.

Arsenical treatment was started May 29. From May 29 to June 27, 1933, he received 5 injections of neoarsphenamine for a total of 1.5 grams; from July 4 to September 19, 1933, 10 injections of sulpharsphenamine for a total of 1.7 grams; from April 9 to September 10, 1935, 18 injections of silver-salvarsan for a total of 3.5 grams; and, as concurrent treatment, 8 milligrams of bismosol, 26 milligrams of bismuth salicylate, 20 injections of thio-bismol for a total of 0.5 gram, and 18 mercury inunctions. From September 17 to December 10, 1935, he received 20 injections of thio-bismol for a total of 0.5 grams.

On December 17, 1935, at 8 a. m., the patient reported to the sick bay for his first injection of the fourth course of arsenical treatment. At this time he stated that he felt well, had eaten no breakfast, and there was no evidence of contraindications for treatment. He was given a 0.3-gram intravenous injection of neoarsphenamine prepared from the identical ampule of neoarsphenamine from which another patient had received a 0.45-gram injection 5 minutes previously.

After the injection process, as the needle was being withdrawn, the patient vomited and complained of abdominal cramps. He was immediately put to bed and given 5 minims of adrenalin hypodermically. Examination revealed: The patient is a young adult male, medium built and robust; apparently normal and healthy except for luetic infection; acutely ill, marked perspiration with signs of shock, and complaints of excruciating pain over region of both kidneys. Temperature, 100° F.; pulse, 118; and blood pressure, 106/68. There is a slight redness of the pharynx. The abdomen is soft and he complains of slight general soreness of the abdominal muscles. There is no rash or erythema.

12 noon. The pain over kidney region continues and perspiration is profuse. The patient is taking fluids freely and there is no vomiting.

2 p. m. The patient voluntarily voids 200 cubic centimeters of urine, which is reddish in appearance and contains numerous blood cells. A Dickens' test shows positive elimination of arsenic.

3 p. m. He is perspiring profusely and reports that the pain in the back over kidney region is still excruciating. He has been taking fluids freely, particularly limeade with plenty of sugar.

3:15 p. m. The pain remains localized over the kidney region. There are no other physical signs except for profuse perspiration. He receives 0.032 gram of codeine sulphate by mouth.

4 p. m. The patient states that he is feeling a little better but the pain in his back is "wearing him out."

4:40 p. m. He receives 0.016 gram of morphine sulphate hypodermically.

6 p. m. The patient is asleep.

10:30 p. m. He is awake, and states he feels fairly well but a dull aching pain remains over the kidney region.

December 18, 8 a. m. The patient states that the pain is not so excruciating. He has not voided since 2 p. m. the previous day.

9:00 a. m. The patient is catheterized and 90 cubic centimeters of urine obtained. Urinalysis: Appearance, black with red tinge; specific gravity, 1.020; reaction, acid; albumin, 3 plus; sugar, negative; microscopical examination, dilute specimen reveals red and white blood cells in such large amounts that further study is impossible. A Dickens' test fails. There are evidences of slight hemorrhage about the lower teeth. The patient takes fluids freely; has been taking sodium chloride 1 gram in fluids every hour by mouth.

10:30 a. m. He receives 1,200 cubic centimeters of 10 percent glucose, intravenously, taking 1 hour and 15 minutes to administer.

1 p. m. The patient is very weak and continues to complain of the pain in his back. Blood pressure 92/48, temperature has ranged from 100° to 105° F., and pulse 120.

4:30 p. m. He is very weak, answers questions readily, but appears to be somewhat confused although there are no physical signs of nervous involvement. Pulse is 120, regular but weak. Has been taking liquids freely. He receives 1 gram of sodium thiosulphate intravenously.

5:30 p. m. The patient now complains of tingling of the lower legs and feet, with sharp stabbing pains of both heels. Babinski—positive; Oppenheim, Gordon, and Shaddock—negative; Brudzinski—slightly positive.

6:30 p. m. The patient suddenly becomes very weak and unconscious. There is labored breathing and terminal paralysis of both legs. He received 0.00065 gram of atropine sulphate hypodermically.

7 p. m. He is extremely weak. Blood pressure is not discernible; temperature, 101° F. He lapsed into a coma, and died at 7:10 p. m., 43 hours after onset of the first symptoms.

OPTIC NEURITIS

Tryparsamide.—(107—1935.) This patient was given a diagnosis of syphilis November 28, 1934, because of generalized lymphadenopathy, repeated 4-plus Kahn blood tests, and a history of exposure in 1932, followed in 1 month by an initial lesion.

From November 28, 1934, to February 12, 1935, he received 10 injections of bismosol; from March 25 to May 1, 1935, 7 injections of neoarsphenamine for a total of 3.3 grams; and from May 8 to July 24, 1935, 10 injections of tryparsamide for a total of 28.5 grams. As concurrent treatment he was given 20 injections of mercury succinimide between the dates of September 9 and October 25, 1935.

On October 30, 1935, he received a 1.5-gram injection of tryparsamide, the first injection of the third course of arsenical treatment and the second course of tryparsamide treatment. Ten and one-half hours after the injection the patient complained of severe headache and blurred vision, especially in his left eye. The visual fields are irregularly contracted, the right slightly and the left markedly. Ophthalmoscopic examination: There is a bilateral intraocular optic neuritis of the clinical type classified as descending neuritis or papillitis, very mild on the right and rather marked on the left. The left disk is hyperemic and moderately swollen, and the inferior and medial one-half of the left retina is hyperemic and blurred, giving the appearance of a mild associated neuro-retinitis. The right disk shows a slight congestion and the right retina is uninvolved. V. O. D. 20/20. V. O. S. 20/40.

November 1. Vision: V. O. D. 20/20; V. O. S. 20/30. Ophthalmoscopic examination: Right disk almost normal; left disk much improved. Right retina normal throughout. Swelling and hyper-

emia in the left disk subsiding rapidly. Fuzzy, blurred appearance of retina shows a marked fading.

His condition gradually improved and his eyes were considered normal after 6 days.

MOSQUITO CONTROL AT PARRIS ISLAND, S. C.

The following is extracted from the Sanitary Reports for the months of May and June from the Marine Barracks, Parris Island, S. C., submitted by Lt. (Jr. Gr.) J. M. Wheelis, Medical Corps, United States Navy.

Twenty-one species were found from January 1 to May 31, 1936, and are listed below (1) in order of the number of specimens obtained, and (2) in order of their frequency of appearance in collections:

<i>Number of specimens</i>		<i>Number of collections</i>	
1. <i>Aedes taeniorhynchus</i>	548	1. <i>A. sollicitans</i>	77
2. <i>A. sollicitans</i>	527	2. <i>A. taeniorhynchus</i>	49
3. <i>C. quinquefasciatus</i>	225	3. <i>C. quinquefasciatus</i>	43
4. <i>A. triseriatus</i>	75	4. <i>A. crucians</i>	26
5. <i>A. crucians</i>	59	5. <i>C. salinarius</i>	22
6. <i>C. restuans</i>	57	6. <i>P. columbiae</i>	22
7. <i>A. vexans</i>	46	7. <i>A. vexans</i>	19
8. <i>P. columbiae</i>	45	8. <i>A. infirmatus</i>	17
9. <i>A. infirmatus</i>	34	9. <i>C. restuans</i>	14
10. <i>A. quadrimaculatus</i>	30	10. <i>A. quadrimaculatus</i>	11
11. <i>C. salinarius</i>	28	11. <i>U. sapphirina</i>	9
12. <i>U. sapphirina</i>	27	12. <i>Culex</i> undet.....	7
13. <i>C. apicalis</i>	19	13. <i>C. apicalis</i>	6
14. <i>Culex</i> undet.....	10	14. <i>Aedes</i> undet.....	5
15. <i>A. canadensis</i>	7	15. <i>A. canadensis</i>	5
16. <i>P. ferox</i>	7	16. <i>P. ferox</i>	4
17. <i>Aedes</i> undet.....	6	17. <i>A. triseriatus</i>	3
18. <i>P. ciliata</i>	3	18. <i>P. ciliata</i>	3
19. <i>A. intrudens</i>	2	19. <i>P. cyanescens</i>	2
20. <i>Psoroph.</i> undet.....	2	20. <i>A. atlanticus</i> (?).....	1
21. <i>P. cyanescens</i>	2	21. <i>A. intrudens</i>	1
22. <i>A. atlanticus</i> (?).....	1	22. <i>Psoroph.</i> undet.....	1
23. <i>P. howardii</i>	1	23. <i>P. howardii</i>	1
24. <i>Anopheles</i> undet.....	1	24. <i>Anopheles</i> undet.....	1
25. <i>Culicella inornata</i>	1	25. <i>Culicella inornata</i>	1

The 11 most common species in point of both numbers of specimens and frequency of appearance in collections are as follows:

1. <i>A. sollicitans</i> .	7. <i>A. vexans</i> .
2. <i>A. taeniorhynchus</i> .	8. <i>A. infirmatus</i> .
3. <i>C. quinquefasciatus</i> .	9. <i>C. restuans</i> .
4. <i>A. crucians</i> .	10. <i>A. quadrimaculatus</i> .
5. <i>C. salinarius</i> .	11. <i>Uranotaenia sapphirina</i> .
6. <i>P. columbiae</i> .	

It is interesting to note that *Uranotaenia sapphirina*, a rare species, which Matheson says "is rarely taken" is eleventh on the list.

Breeding became widespread on Parris Island in February. Between then and May 1 there were times when there were as many as 250 field locations, distributed throughout the island, breeding at one time. Except for a few toward the southern portion of the island, these were successfully kept under control. The only species which have given any trouble have been domestic species which breed in innumerable artificial containers and require constant search, with, now and then, a few escaping. The weedland and salt marsh problems have responded readily to present methods of control. There has been no rain of any consequence since the early part of April and most of the field locations are dry. Therefore the inspections and oilings have had ample time for thoroughness. It is believed certain that the infestation described below was not due to local breeding.

For the 5 days preceding the night of May 27-28 the average number of mosquitoes per trap was 0.85. There was a strong east wind during most of that time. In the morning collection of May 28 there was an average of 5.4 mosquitoes per trap and on the 29th there were 91 per trap. The averages for the next few days were: June 1, 51; June 2, 25.5; June 3, 39; June 4, 16.6; and June 5, 15. There were apparently two distinct flights of *sollicitans* and *taeniorhynchus*, one predominating in the former from St. Helena and one predominating in the latter from Ladies Island and Cat Island. The following table shows the incidence of *Aedes sollicitans* and *A. taeniorhynchus* in each trap for the period of May 28 to June 5, inclusive:

	May 28	May 29	June 1	June 2	June 3	June 4	June 5	Total	Per- cent
Trap no. 2:									
<i>A. sollicitans</i>	3	25	14	24	13	8	5	92	29
<i>A. taeniorhynchus</i>	3	44	44	44	42	19	25	221	71
Trap no. 3:									
<i>A. sollicitans</i>	0	9	14	1	6	3	1	34	58
<i>A. taeniorhynchus</i>	0	4	15	1	4	1	0	25	42
Trap no. 4:									
<i>A. sollicitans</i>	1	21	8	12	8	9	3	62	39
<i>A. taeniorhynchus</i>	1	9	21	12	15	17	21	96	61
Trap no. 5:									
<i>A. sollicitans</i>	26	252	48	38	64	24	7	459	71
<i>A. taeniorhynchus</i>	2	68	39	11	40	11	17	188	29
Trap no. 6:									
<i>A. sollicitans</i>	0	2	38	1	5	2	2	50	45
<i>A. taeniorhynchus</i>	0	12	37	0	4	0	7	60	55
Trap no. 7:									
<i>A. sollicitans</i>	0	2	2	2	4	0	0	10	13
<i>A. taeniorhynchus</i>	1	3	24	7	27	2	1	65	87

It will be noted that the May 28 catching (from the night before) showed an increased number of *sollicitans* in trap no. 5 with no involvement of the other traps. The next day traps nos. 3 and 4 each contained a small and no. 5 a very large catch with *sollicitans* predominating. Trap no. 6 contained no specimens on the 28th, a small number on the 29th, and a more definite increase on June 1 with an approximately equal number of each species. The increased catchings

of trap no. 2 began on the night of May 28-29 with a predominance of *taeniorhynchus*. This predominance has been consistent as the predominance of *sollicitans* (except June 5) has been in no. 5. Trap no. 7 showed an increase until June 1 when *taeniorhynchus* predominated and has continued to do so. It was apparently in the edge of the same flight involving trap no. 2. Trap no. 4 was apparently in line more with no. 2 than with no. 5 and trap no. 3 more with no. 5 than no. 2. Trap no. 6 appeared to be on the distant ends of the flights from both no. 2 and no. 5.

The heaviest catchings were in traps no. 2 and no. 5 with a distinct predominance of *taeniorhynchus* (71 percent) in the former and a distinct predominance of *sollicitans* (71 percent) in the latter.

The flight involving trap no. 2 apparently proceeded in a south-westerly direction against a light southwest breeze from Ladies and Cat Islands. Had it come from the area of Port Royal there should have been more influence shown on trap no. 7 which would have been closer to the source and trap no. 3 which would have been more in the line of flight. Trap no. 6 would then have shown a predominance of *sollicitans* as it would have been out of the line of flight from no. 2. Had it come from St. Helena, traps no. 3 and no. 4 should have been equally involved with no. 2.

The flight involving trap no. 5 apparently proceeded west or west by south across and into a light southwest breeze from St. Helena. Had it had a northward trend, traps no. 2, no. 3, and no. 4 should have been more involved and no. 7 should eventually have shown more *sollicitans*. Had it come in a southwest direction it should have affected traps no. 2, no. 3, and no. 4 even more than no. 5.

The evidence shown above seems to indicate: 1. That, beginning the night of May 27, there was a flight of *sollicitans* and *taeniorhynchus*, the former predominating, from St. Helena, the direction being west or west by south toward the southeastern third of Parris Island and across and into a light southwest breeze. 2. That, beginning the night of May 28, there was a flight of *sollicitans* and *taeniorhynchus*, the latter predominating, from Ladies and Cat Islands, the direction of progress being southwest toward the middle third of Parris Island and into a light southwest breeze.

These conclusions are based chiefly on the following points: 1. The mosquitoes which became so suddenly present are of the "salt marsh" type noted for their distance of flight. 2. The most annoyance was first noted on the hospital reservation near which there are no tide-water retention areas which breed and which (trap no. 2) is the nearest point to Ladies and Cat Islands. 3. The distinct predominance of *sollicitans* in trap no. 5. 4. The distinct predominance of *taeniorhynchus* in trap no. 2. 5. The slowness of trap no. 7 in showing any results and its predominance of *taeniorhynchus*. 6. The

more nearly balanced ratios of traps no. 3 and no. 4. 7. The slowness of trap no. 6 in showing any results and its lack of appreciable predominance of either species. 8. The scarcity of breeding on Parris Island as determined by constant inspections and controlled by oiling operations.

Many complaints of mosquitoes were received during this time but they have already decreased. A noticeable decrease in number of mosquitoes on the wing began about June 4 and it is apparent from general observations and from trap collections that the infestation is beginning to subside, at least in the main station and training station areas.

It is unfortunate that, due to proximity of other islands, complete control of Parris Island does not insure absolute freedom from mosquitoes. It is believed that such flights will be of such infrequent and temporary nature that they will be of relatively little practical importance and will be more than offset by longer periods of almost complete freedom from annoyance. It is believed that this flight was the result of combination of favorable meteorological conditions and very heavy breeding at the source. *Aedes taeniorhynchus* and *sollicitans* are not known to carry any disease. Attention is invited to the fact that there was no increase in *Anopheles quadrimaculatus* and *crucians* or *Culex quinquefasciatus*. These disease vectors, which are all within our 10 most common species, do not fly far and local control will undoubtedly result in local freedom.

During June, 111 staked field locations and 316 manholes have been oiled. Nearly all of the field locations were salt-water retention areas breeding *Aedes taeniorhynchus* and *Aedes sollicitans*. A total of 918 gallons of oil were used. A very large number of artificial containers were found breeding and disposed of. The identifications for the month of June were as follows:

Parris Island:	
Larvae.....	3, 034
Adults.....	9, 253
From off Parris Island.....	148
<hr/>	
Total.....	12, 435
Brought forward.....	1, 770
<hr/>	
Total to date.....	14, 205

Two simultaneous flights of mosquitoes across Beaufort River from neighboring islands began on May 28 and diminished so that they were no longer troublesome by June 16. During the period of May 28 to June 16, inclusive, the average catch per trap per day was 34.4 with 59 percent *A. taeniorhynchus* and 38 percent *A. sollicitans*, a total of 97 percent salt marsh mosquitoes. These lay their eggs on moist or dry ground in situations where they will later be floated by tidewater.

A period of high tides began on June 13 reaching a maximum height of 9.1 feet on June 19. On about June 15, large numbers of newly hatched *Aedes* larvae began to appear in salt marsh retention areas. These were the progeny of the individuals of the previous infestation. Every effort was made to find and oil all locations breeding, but on June 22 or 23 they began to appear on the wing and during the period of June 23 to 30 the average catch per trap per day was 122 with 79 percent *A. taeniorhynchus* and 19 percent *A. sollicitans*, a total of 98 percent salt marsh types.

Whereas in the May 28 to June 16 infestation the distribution of trap catchings was such as to indicate a major proportion of the specimens being of foreign origin, the distribution from June 23 to 30 has been the opposite. There may have been a flight from Ladies Island or St. Helena during the week end of June 27, 28, and 29 as traps 4, 3, and 2 showed the heaviest catches. Nevertheless traps 5, 4, and 6 had been the heaviest at first and it was obvious that control during the latter part of June had fallen short of complete success. Whether this is due to incomplete inspection and oiling of known locations, and/or activity of undiscovered locations is yet to be determined. Every effort is being made to find and correct the cause.

It would be impossible to state just how much worse the infestation would have been in the absence of any control. It is believed that it would have been extremely heavy. It is known that countless millions, possibly 90 percent, of larvae have been found and killed. *Culex quinquefasciatus* is one of the most annoying of all mosquitoes, as it is domesticated in its habits and is the disturber par excellence of sleep. In spite of the fact that it is third in order of predominance and comprised 68 percent of all larvae identified, only 0.7 percent of all adult identifications were or could have been *quinquefasciatus*. In order to determine this figure all *Culex* undetermined were included as *quinquefasciatus*.

It is believed that present experiences, of which detailed records are being kept, will serve as a basis for more complete success later. There appear to be some flaws in the present system which need discovery and correction. It remains to be proven of just what practical importance flights from surrounding islands will be over a period of time.

AN OUTBREAK OF FOOD POISONING CAUSED BY HAM—MARINE BARRACKS, QUANTICO, VA.

An outbreak of food poisoning occurred at the Marine Barracks, Quantico, Va. on June 11, 1936. As reported by the post surgeon, by 4:30 p. m. over 250 men were brought to sick quarters suffering from abdominal cramps, nausea, vomiting, diarrhea, and collapse, ranging from a mild to a severe degree. At least four patients also presented

hematemesis and melena. The first indication of illness occurred 4 hours after eating in the majority of cases. A few men reported to dispensary 18 hours after eating and in 2 cases there was an interval of 42 hours.

A total of 229 cases were admitted and retained at sick quarters. However, a few mild cases returned to their barracks after receiving treatment and some milder cases failed to report for treatment. Of the 229 cases admitted to sick quarters, 209 were discharged on June 12, 1936, and 20 on June 13.

The onset of symptoms (weakness, nausea, and vomiting) was sudden, followed by spasmodic abdominal pains, which became more or less continuous due to retching and straining, and diarrhea with watery, offensive, blood-tinged stools. Collapse, sudden prostration, cyanosis, and muscular cramps in the legs were observed in some cases.

Large cupfuls of sodium chloride solution were given followed later by castor oil and paregoric. Hypodermic injections of morphine were administered in some instances. A rapid and uneventful recovery was noted for each patient.

Ham served at the mid-day meal on June 11 was the suspected food. All men affected had consumed food in Barracks "E" but practically the same food was served in eight other messes. It seems not improbable that the 200 pounds of ham with cabbage, cooked the night before and left overnight in the container to gradually cool, was infected before or after cooking.

Laboratory examinations of stools, urine, and vomitus were essentially negative. Samples of food failed to show any etiological significance except that a staphylococcus albus was obtained from a whole ham. It is assumed that the causative agent was either staphylococcus albus or *Bacillus enteritidis*.

SHOE MEASURING DEVICES

Experience has shown that the proper fitting of shoes has a bearing upon personal efficiency. It is believed that the problem of properly fitting shoes has been partially solved if the medical officers will familiarize themselves with the foot measuring devices which have been furnished all issuing activities.

In official correspondence to the Bureau of Medicine and Surgery the Bureau of Supplies and Accounts states that it "will appreciate any assistance in its efforts to assure that the enlisted men will receive correctly fitted shoes."

HEALTH OF THE NAVY

The following tables are summaries of morbidity rates per 1,000 for the second quarter of 1936 in comparison with rates for the corresponding quarter of the preceding 5 years:

Entire Navy

Year	All diseases	Injuries	Poisonings	All causes	Communicable diseases		Venereal diseases
					A	B	
1931.....	443	53	0.36	497	(1)	(1)	137
1932.....	470	51	.33	521	(1)	(1)	141
1933.....	407	62	1.51	470	18	75	100
1934.....	385	67	.45	452	35	116	64
1935.....	371	65	1.88	438	28	85	62
1936.....	337	49	.07	386	30	140	42

Forces ashore

1931.....	528	65	0.20	593	(1)	(1)	87
1932.....	542	44	.31	586	(1)	(1)	92
1933.....	456	78	.91	555	23	96	79
1934.....	621	87	1.15	709	76	230	58
1935.....	491	78	1.53	571	54	110	45
1936.....	518	50	.09	568	59	226	26

Forces afloat

1931.....	397	46	0.44	444	(1)	(1)	165
1932.....	431	54	.34	486	(1)	(1)	168
1933.....	369	54	1.80	424	16	64	111
1934.....	271	57	.11	328	15	62	67
1935.....	312	58	2.06	372	16	72	71
1936.....	229	49	.05	278	13	89	51

¹ Not available.

Mumps.—The United States naval training station, Norfolk, Va., reported 88 cases for the quarter, an increase of 35 over the first quarter of the year. The senior medical officer reports that this increase is due to the continued cases in Norfolk and vicinity and to the fact that recruits arrive daily from many homes where mumps has been known later to exist, making it manifestly impracticable to initiate any platoon or other quarantine. The U. S. S. *Arizona* reported 46 cases; U. S. S. *Maryland*, 39; U. S. S. *Indianapolis*, 29; United States naval training station, Great Lakes, Ill., 19; American Embassy, Peiping, China, 21; U. S. S. *Oklahoma*, 17; Fourth Marines, Shanghai, China, 12; U. S. S. *Chaumont*, 11; and U. S. S. *Lea*, 10.

Cerebrospinal fever.—There were seven cases of cerebrospinal fever reported during April, May, and June, 1936, as follows:

Rate	Age	Place of original admission	Date of admission	Length of service (years)	Disposition
A. S.	19	Naval training station, Norfolk, Va.	Apr. 17, 1936	10 days....	Duty, July 17, 1936.
M. Att. 3c....	21	do.....	do.....	3½.....	Duty, July 14, 1936.
W. T. 1c....	32	U. S. S. <i>Minneapolis</i>	May 20, 1936	12¾.....	Duty, June 5, 1936.
F. 2c....	21	U. S. S. <i>New Mexico</i>	May 21, 1936	2¾.....	Died, May 31, 1936.
A. S.	19	Naval training station, San Diego, Calif. ¹	June 3, 1936	¾.....	Still on list.
Sea. 1c....	27	U. S. S. <i>Relief</i> (crew).....	June 11, 1936	6.....	Duty, July 21, 1936.
S. C. 3c....	27	U. S. S. <i>Ramapo</i>	June 14, 1936	8¾.....	Still on list.

¹ Recruit developed the disease 5 days after returning to duty from leave.

German measles.—A total of 180 cases of German measles was reported from the entire Navy during the quarter. Outbreaks which started at several of the naval establishments in March continued through April. The incidence of the disease for the second quarter was as follows: Naval training station, Norfolk, Va., 24 in April, 13 in May, and 18 in June; naval training station, San Diego, Calif., 26 in April, 16 in May, and 2 in June; Fourth Marines, Shanghai, China, 21 in April; and the U. S. S. *Lexington*, 40 in April.

Scarlet fever.—Thirteen cases of scarlet fever were recorded for ships and shore stations during the quarter as compared with 63 admissions for the previous quarter. The U. S. S. *Nevada* reported five cases in April and one in May; naval training station, Great Lakes, Ill., U. S. S. *Arizona*, U. S. S. *Texas*, U. S. S. *New York*, and the U. S. S. *Relief* (crew), one case each in April; U. S. S. *Maryland*, one case in May; and the submarine base, Coco Solo, C. Z., one case in June.

The case reported by the naval training station, Great Lakes, Ill., was a recruit who was admitted to the sick list 10 days after he arrived at detention camp.

The submarine base, Coco Solo, C. Z., reported as follows in the sanitary report for the month of May: "A draft of 39 marines arrived from Norfolk, Va., on the S. S. *Virginia* on 22 May. On arrival one man was sick and was isolated in the dispensary. On the following morning condition was diagnosed as scarlet fever. The draft was isolated, Dick tested, and the five men who were found to be susceptible immunized with scarlet fever serum. No further cases have developed."

Chickenpox.—Eight cases of chickenpox were reported for the quarter as follows: In April one from the submarine base, New London, Conn.; in May, two from the U. S. S. *Edsall*, and one each from the naval training station, Newport, R. I., fleet air base, Pearl Harbor, T. H., U. S. S. *Maryland*, and the U. S. S. *Ranger*; and in June, one from the U. S. S. *Milwaukee*.

Typhoid fever and paratyphoid fever.—A seaman, first-class, 21 years of age, with slightly more than a year's service, was transferred from

the U. S. S. *Pennsylvania* to the U. S. S. *Relief* on June 16, 1936, with symptoms of typhoid fever. The patient grew progressively worse and died July 4, 1936. The contributory cause of death was recorded as peritonitis, general, acute. One course of typhoid prophylaxis had been completed June 3, 1935.

A mild case of paratyphoid fever "B", with no complications, was reported by the Navy Yard, Mare Island, Calif. The source of infection was unknown. The patient, a machinist's mate, first class, 32 years of age, with 9½ years' service, was admitted to the sick list on April 5 and returned to duty July 4, 1936. Two complete courses of typhoid prophylaxis had been administered—one in August 1926 and one in December 1930.

Acute intestinal disorder, U. S. S. "Lexington."—On May 7, 1936, 35 enlisted men reported at the sick bay with symptoms of diarrhea, mild prostration, abdominal colic, rapid pulse, and subnormal temperature. Recovery was rapid and complete.

Turkey, which had been served at general mess the previous day, was found to be the cause of the outbreak.

No bacteriological examination of stools was possible at the time.

Common infectious diseases of the respiratory type.—A total of 2,715 admissions was reported from the entire Navy during the second quarter of the year 1936, or a 59-percent decrease from the number of cases notified for the preceding quarter. Catarrhal fever was responsible for 898 of the total admissions for these diseases.

Ships and shore stations reporting the largest number of cases were as follows:

	April	May	June	Total
Naval training station, Norfolk, Va.	114	47	53	214
Naval training station, San Diego, Calif.	74	71	46	191
Naval training station, Great Lakes, Ill.	108	23	18	149
Marine Barracks, Quantico, Va.	49	48	24	121
Naval training station, Newport, R. I.	62	24	24	110
Naval Academy, Annapolis, Md. (midshipmen)	40	10	5	55
Naval Air Station, Pensacola, Fla.	39	23	22	84
Fleet air base, Coco Solo, Canal Zone.	23	17	6	46
U. S. S. <i>Lexington</i>	6	31	10	47
U. S. S. <i>New Mexico</i>	9	27	8	44
U. S. S. <i>Tennessee</i>	8	14	18	40
U. S. S. <i>Arizona</i>	8	24	6	38
U. S. S. <i>Saratoga</i>	13	10	12	35

Summary of morbidity in the United States Navy for the quarter ended June 30, 1936

Average strength.....	Forces afloat 75,844		Forces ashore 45,218		Entire Navy 121,062	
	Admis- sions	Rate per 1,000	Admis- sions	Rate per 1,000	Admis- sions	Rate per 1,000
All causes.....	5,270	277.94	6,418	567.74	11,688	396.18
Disease only.....	4,339	228.84	5,851	517.58	10,190	336.69
Injuries.....	930	49.05	566	50.07	1,496	49.43
Poisonings.....	1	.05	1	.09	2	.07
Communicable diseases transmissible by oral and nasal discharges (class VIII):						
(A).....	243	12.82	664	58.74	907	29.97
(B).....	1,683	88.76	2,553	225.84	4,236	139.96
Venereal diseases.....	971	51.21	295	26.10	1,266	41.63

Deaths reported, entire Navy, during the quarter ended June 30, 1936

Cause—Disease		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Average strength.....	.....	9,613	1,889	91,761	1,225	16,207	367	121,062
Abscess, lung.....	None.....	1	.....	.....	.....	.....	.....	1
Appendicitis, acute.....	Intestinal obstruction from spastic or paralytic causes.....	.....	.....	1	.....	.....	.....	1
Do.....	Peritonitis, general, acute.....	.....	.....	3	.....	.....	.....	3
Do.....	Poisoning, anesthesia, ether.....	.....	.....	1	.....	.....	.....	1
Cellulitis, pelvic region.....	Peritonitis, general, acute.....	.....	.....	1	.....	.....	.....	1
Cerebrospinal fever.....	None.....	.....	.....	1	.....	1	.....	2
Diabetes mellitus.....	Pneumonia, lobar.....	.....	.....	1	.....	.....	.....	1
Hemorrhage, cerebral.....	None.....	.....	.....	1	.....	.....	.....	1
Hernia, inguinal.....	Embolism, subclavian and vertebral arteries.....	.....	.....	1	.....	.....	.....	1
Influenza.....	Myocarditis, chronic.....	.....	.....	1	.....	.....	.....	1
Myocarditis, chronic.....	Arteriosclerosis, general.....	.....	.....	.....	.....	1	.....	1
Nephritis, chronic.....	Myocarditis, chronic.....	.....	.....	1	.....	.....	.....	1
Neuritis, multiple.....	Pneumonia, lobar.....	.....	.....	1	.....	.....	.....	1
Otitis, media, acute.....	Abscess, brain.....	.....	.....	1	.....	.....	.....	1
Paralysis, ascending, acute.....	None.....	.....	.....	.....	.....	1	.....	1
Peritonitis, general, acute.....	Pneumonia, broncho.....	.....	.....	1	.....	.....	.....	1
Pneumonia, lobar.....	None.....	.....	.....	4	.....	.....	.....	4
Do.....	Dementia praecox.....	.....	.....	1	.....	.....	.....	1
Do.....	Meningitis, cerebrospinal, acute.....	.....	.....	1	.....	.....	.....	1
Polypus, intestines.....	Hemorrhage, intestines.....	.....	.....	1	.....	.....	.....	1
Psychosis, exhaustive.....	Edema, lungs.....	.....	.....	1	.....	.....	.....	1
Thrombosis, cavernous sinus.....	Pneumonia, broncho.....	.....	.....	1	.....	.....	.....	1
Thrombosis, coronary.....	None.....	1	.....	3	.....	.....	.....	4
Do.....	Arteriosclerosis, general.....	.....	.....	1	.....	.....	.....	1
Do.....	Dilatation, cardiac, acute.....	.....	.....	1	.....	.....	.....	1
Do.....	Myocarditis, chronic.....	.....	.....	1	.....	.....	.....	1
Tonsillitis, acute.....	Abscess, lung.....	.....	.....	1	.....	.....	.....	1
Do.....	Septicemia.....	.....	.....	1	.....	.....	.....	1
Tuberculosis, pulmonary, acute pneumonic.....	None.....	.....	.....	1	.....	.....	.....	1
Tuberculosis, pulmonary, acute general miliary.....	.....do.....	.....	.....	1	.....	.....	.....	1
Tuberculosis, pulmonary, chronic.....	None.....	.....	.....	1	.....	.....	.....	1
Tuberculosis, pulmonary, chronic.....	Hemorrhage, pulmonary.....	.....	.....	1	.....	.....	.....	1
Total for disease.....	.....	2	.....	36	.....	3	.....	41
CAUSE—INJURIES AND POISONINGS								
Burn, multiple.....	None.....	1	.....	2	.....	.....	.....	3
Contusion, nose.....	Hemorrhage, traumatic, nose.....	.....	1	.....	.....	.....	.....	1
Crush, chest.....	None.....	.....	.....	1	.....	.....	.....	1
Drowning.....	.....do.....	4	.....	12	.....	1	.....	17
Do.....	Intracranial injury.....	.....	.....	1	.....	.....	.....	1
Fracture, compound, skull.....	None.....	.....	.....	2	.....	.....	.....	2
Do.....	Hemorrhage, intracranial.....	.....	.....	1	.....	.....	.....	1
Fracture, simple, occipitoparietal.....	Hemorrhage, subdural.....	1	.....	.....	.....	.....	.....	1
Fracture, simple, skull.....	Intracranial injury.....	.....	.....	1	.....	.....	.....	1
Fracture, simple, vertebrae, cervical.....	Intraspinal injury.....	.....	.....	.....	.....	1	.....	1
Fracture, simple, vertebrae, dorsal.....	Dementia praecox.....	.....	.....	1	.....	.....	.....	1
Injuries, multiple, extreme.....	None.....	2	.....	6	.....	1	.....	9
Wound, gunshot:	.....do.....	.....	.....	.....	.....	1	.....	1
Chest.....	.....do.....	.....	.....	.....	.....	.....	.....	1
Head.....	.....do.....	1	.....	.....	.....	.....	.....	1
Wound, punctured, heart.....	.....do.....	.....	.....	1	.....	.....	.....	1

Deaths reported, entire Navy, during the quarter ended June 30, 1936—Con.

Cause—Disease		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Poisoning, acute:								
Lysol.....	None.....			1				1
Sodium cyanide.....	do.....			1				1
Total for injuries and poisonings.....		9	1	30		4		44
Grand total.....		11	1	66		7		85
Annual death rates per 1,000:								
All causes.....		13.73	6.35	8.63		5.18		8.43
Disease only.....		2.50		4.71		2.22		4.06
Drowning.....		4.99		1.70		.74		1.78
Poisoning.....				.26				.20
Other injuries.....		6.24	6.35	1.96		2.22		2.38

ADMISSIONS FOR INJURIES AND POISONINGS, SECOND QUARTER, 1936

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the second quarter, 1936, is based upon all form F cards covering admissions in those months which have reached the Bureau.

	Admissions, April, May, and June 1936	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1935
INJURIES			
Connected with work or drill.....	677	2,237	2,592
Occurring within command but not associated with work.....	476	1,573	1,709
Incurred on leave or liberty or while absent without leave.....	343	1,133	1,651
All injuries.....	1,496	4,943	5,952
POISONINGS			
Industrial poisoning.....	1	3	17
Occurring within command but not connected with work.....	0	0	43
Associated with leave, liberty, or absence without leave.....	1	3	19
Poisonings, all forms.....	2	7	79
Total injuries and poisonings.....	1,498	4,950	6,030

Percentage relationships

	Occurring within command				Occurring outside command—leave, liberty, or absent without leave	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	April, May, and June 1936	Year 1935	April, May, and June 1936	Year 1935	April, May, and June 1936	Year 1935
Percent of all injuries.....	45.3	43.6	31.8	28.7	22.9	27.4
Percent of all poisonings.....	50.0	21.1	0	54.4	50.0	24.7
Percent of total admissions, injury, and poisoning titles.....	45.3	45.3	31.8	29.0	22.9	27.7

NOTE.—Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism", as the case may be. Such cases are not included in the above figures. There were no cases during the second quarter of 1936 worthy of notice from the standpoint of accident prevention.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following statistics were taken from monthly sanitary reports submitted by naval training stations:

April, May, and June 1936	U. S. naval training station			
	Norfolk, Va.	Newport, R. I.	Great Lakes, Ill.	San Diego, Calif.
Recruits received during the period.....	1,436	960	991	1,228
Recruits appearing before Board of Medical Survey.....	8	0	3	0
Recruits recommended for discharge from the service.....	8	0	3	0
Recruits discharged by reason of medical survey.....	7	0	2	0
Recruits held over pending further observation.....	0	0	0	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment.....	43	32	6	18

The following table was prepared from reports of medical surveys in which disabilities or disease causing the surveys were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Abcess, periapical.....	1	Hydronephrosis.....	1
Amblyopia.....	1	Malocclusion, teeth.....	2
Arterial hypertension.....	1	Metatarsalgia, bilateral.....	1
Asthma.....	1	Myositis, chronic.....	2
Astigmatism.....	1	Nephritis, chronic.....	3
Absence, acquired, teeth.....	2	Neuritis.....	2
Bronchitis, chronic.....	1	Otitis, media, chronic.....	3
Caries, teeth.....	3	Periostitis, chronic.....	1
Chancroidal lymphadenitis.....	1	Psychoneurosis, hysteria.....	2
Color blindness.....	1	Psychoneurosis, neurasthenia.....	1
Constitutional psychopathic state, emotional instability.....	2	Psychoneurosis, unclassified.....	1
Constitutional psychopathic state, inadequate personality.....	2	Pyelitis, chronic.....	1
Deafness, unilateral.....	1	Pyorrhea alveolaris.....	1
Deformity, acquired, navicular bone, right foot.....	1	Residuals intracranial injury.....	1
Deformity, acquired, right ankle.....	1	Rheumatism, muscular.....	1
Deformity, acquired, right wrist.....	1	Sinusitis, maxillary.....	1
Dementia praecox.....	1	Sprain, right sacroiliac joint.....	1
Enuresis.....	7	Syphilis.....	8
Epilepsy.....	10	Tenosynovitis, chronic.....	1
Flat foot.....	1	Teratoma, retrococygeal.....	1
Glycosuria.....	1	Trichophytosis, hands and feet.....	2
Goiter.....	1	Ulcer, duodenum.....	1
Hammer-toe.....	1	Union of fracture, faulty.....	2
Hernia, inguinal.....	2	Valvular heart disease, aortic stenosis.....	1
		Valvular heart disease, mitral insufficiency.....	3
		Valvular heart disease, mitral stenosis.....	2

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VOLUME XXXV

APRIL 1937

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NUMBER 2

United States Naval Medical Bulletin

PUBLISHED *for the* INFORMATION OF
MEDICAL DEPARTMENT *of the* NAVY



THE MISSION OF THE MEDICAL CORPS OF THE NAVY

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**TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**

Issued Quarterly by the Bureau of Medicine and Surgery
Washington, D. C.

VOL. XXXV

APRIL 1937

No. 2

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THE MEDICAL DEPARTMENT OF THE NAVY



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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

Volume IX, no. 1, January 1915.
Volume X, no. 2, April 1916.
Volume XI, no. 3, July 1917.
Volume XII, no. 1, January 1918.
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APR 13 1937

TABLE OF CONTENTS

	Page.
PREFACE.....	v
NOTICE TO SERVICE CONTRIBUTORS.....	vi
SPECIAL ARTICLES:	
NAVAL DELINQUENCY.	
By H. O. Cozby, lieutenant, Medical Corps, United States Navy..	157
IMMUNITY IN SYPHILIS.	
By C. S. Butler, rear admiral, Medical Corps, United States Navy..	173
PRESENT DAY CONCEPTS OF ENDOCRINOLOGY.	
By Paul F. Dickens, lieutenant commander, and Omar J. Brown, lieutenant, Medical Corps, United States Navy.....	176
LYMPHEDEMA OF THE EXTREMITIES.	
By Edgar V. Allen, M. D., Division of Medicine, The Mayo Clinic, and Irwin L. Norman, lieutenant, Medical Corps, United States Navy.....	196
AN ESTIMATE OF ARSENOXIDE (MAPHARSEN) IN THE TREATMENT OF EARLY SYPHILIS.	
By R. P. Parsons, commander, Medical Corps, United States Navy..	207
THE APPLICATION OF MEASUREMENTS OF NITROGEN ELIMINATION TO THE PROBLEM OF DECOMPRESSING DIVERS.	
By Albert R. Behnke, lieutenant, Medical Corps, United States Navy.....	219
AN ANALYSIS OF EIGHTEEN SYPHILITIC REINFECTIONS.	
By J. A. Millsbaugh, lieutenant, junior grade, Medical Corps, United States Navy.....	240
PRINCIPLES UNDERLYING THE DIAGNOSIS AND TREATMENT OF PSY- CHIATRIC CASES.	
By James L. McCartney, lieutenant commander, United States Naval Reserve.....	244
CLINICAL NOTES:	
REPORT OF A CASE OF ADENOCARCINOMA OF CERVIX WITH RAPID METASTASIS.	
By Thomas G. Hays, lieutenant, junior grade, Medical Corps, United States Navy.....	253
REPORT OF A CASE OF FATAL POISONING FROM SODIUM FLUORIDE.	
By M. R. Wirthlin, lieutenant, junior grade, Medical Corps, United States Navy.....	255
RENAL DYSTOPIA.	
By John F. Luten, lieutenant, Medical Corps, United States Navy.....	256
NAVAL RESERVE.....	259
NOTES AND COMMENTS:	
The Thirteenth Surgeon General, United States Navy—Caution in Regard to the Use of the Provocative Wassermann—A Census of the Periodic Literature on Syphilis—Clinical Evidence of the Toxic Effects from Injections of Organic Arsenical Compounds—Some New Methods Suggested in the Treatment of Burns—Bound Sets of the United States Naval Medical Bulletin—The Discovery and Isolation of the Active Principle of Ergot—Research on Seasick- ness—The Wellcome Prize—American Neisserian Society.....	261

	Page
BOOK NOTICES:	
Remington's Pharmacy, Cook—Medicine, Meakins—Medicine, Emerson—Anatomy, Gray—Surgery, Cole and Elman—Dental Materials, Skinner—Oral Diagnosis, Thoma—Urology, Cabot—Psychiatric Examination, Appel and Strecker—Diseases of Nails, Pardo-Castello—Roentgen Interpretation, Holmes and Ruggles—Human Physiology, Starling—Pharmacology and Therapeutics, Cushny—Holt's Diseases of Children, Holt and Howland—Medicine and Mankind, Galdston—Physiology, Howell—Proctology, Yeomans—Chemistry, Roe—Health and Hygiene, Bolduan—Tissue Immunity, Kahn—Diseases of Women, Crossen—Obstetrics, Schumann—Pharmacology, Sollmann—Diseases of Respiratory Tract, 21 Contributors—Pathology, MacCallum—Neuro-Anatomy, Kuntz—Neurological Surgery, Davis—Dental X-Ray Technique, Greenfield—Dental Roentgenology, Wald.....	269
ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES IN 1936.....	281
PREVENTIVE MEDICINE.....	285
HEALTH OF THE NAVY—STATISTICS.....	285

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, and reports from various sources, notes and comments on topics of medical interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

P. S. ROSSITER,
Surgeon General, United States Navy.

v

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Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated, if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

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The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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SPECIAL ARTICLES

DELINQUENCY IN THE UNITED STATES NAVY

INCIDENCE AND RECENT TRENDS

By H. O. Cozby, Lieutenant, Medical Corps, United States Navy

Every medical officer from time to time must deal with some aspect of delinquency in the Navy. He often serves as a member of courts martial; sometimes he is the officer making the report of an offense; again, as commanding officer in our hospitals, he awards punishments and courts martial as provided under naval law. The medical officer may be required to examine and report upon the individual delinquent as to drunkenness, drug addiction, venereal disease, physical fitness for confinement, punishment, and imprisonment.

The psychiatrist is especially concerned with the problems of mental disease and mental defect and the associated questions of responsibility and irresponsibility. Capital offenses being very rare in the naval service, the questions of responsibility and irresponsibility are most commonly encountered in other offenses involving imprisonment, triable by general courts martial. However, in a much larger number of offenses against discipline, generally tried by inferior courts, the psychiatrist is frequently concerned with the aspects of the conduct as a symptom of mental disorder. To be sure these delinquencies are of varying degree of severity, but repeated minor infractions of discipline by one individual may be of equal or greater significance than a single major offense in another. The mentally abnormal individual is frequently in conflict with naval law, and many cases of mental abnormality come to light through delinquencies. Similar observations have been made by numerous writers (1).

The psychiatrist does not say that all delinquents are abnormal nor does he condone their misbehavior. Healy (2), the pioneer worker in the field of juvenile delinquency, would not "place delinquents as such in the list of abnormal individuals." The psychiatrist should not usurp the functions of naval law, but within its frame-

work assist in the administrative solution of problems of discipline and justice. In this general connection Nelson (3) says:

There seems to be an impression among nonmedical individuals that the psychiatrist seeks to condone the offender's misdeeds and relieve him from any responsibility for his acts. This is far from the truth. What the psychiatrist does seek to do is to secure the most effective as well as humane way of dealing with the individual.

Problem.—Adequate and precise knowledge is fundamental to effective planning and treatment. What progress has been made? King's (1, c) early work showed that over 30,000 or 12 percent of 250,704 United States Army enlistment contracts during the fiscal years 1908-13, inclusive, were terminated by military delinquency. He also showed that of the 30,000 delinquents more than 23,000 deserted; in a series of 1,000 intensively studied cases he found 3 percent psychotic, 1.6 percent epileptic, alcoholism in 20 percent, extreme immaturity in 8 percent as well as other miscellaneous psychiatric factors. What of the gloomy prophecy found in the Annual Report of the Judge Advocate General of the Navy (p. 28) for 1912, which reads as follows:

The tables show that general and summary courts martial and deck courts reviewed constitute a fixed percentage of the men in the naval service; general courts martial approximate 2 percent; summary courts martial approximate 12 percent; and deck courts approximate 9 percent.

No recent study of comparable nature has been found for the United States Navy. The central problem of this article, therefore, will be an inquiry into the recent incidence and trends of delinquency in the naval service, the extent, grade, and frequency of offenses, as well as possible causes and conditioning factors.

Method.—Division 1 of the Office of the Judge Advocate General of the United States Navy is concerned with the administration of justice, which among other things, comprehends military law, review of all courts martial and matters relating to prisons and prisoners. Considerable statistical data regarding the work of this division is available in tables which are appended to the annual reports of the Judge Advocate General of the Navy. The pertinent data for the 6-year period, 1930-35, has been analyzed and compiled in composite tables for the period. For the editing and compression the author is alone responsible. Other available statistical data, especially from the annual reports of the Surgeon General, United States Navy, has been freely used. The aim has been to present in simple and accessible form the factual evidence and quantitative data from which inferences are drawn.

Comment on statistics.—Although the reports of the Judge Advocate General are somewhat fuller in more recent years than formerly

they still lack information in regard to the many social-psychiatric factors which are fundamental to any knowledge of the individual offender. A complete story is lacking and many assumptions cannot be made and convincingly defended from the evidence available, but there must be a beginning. Thus, even in so vital a matter as the age of the offender, we are left without information. In connection with the age of the offender, Richard C. Cabot (4) illuminatingly remarks that certain types of crime may be—

a symptom of a self-limited disease of personality, which ordinarily runs its course during the years from 16 to 35 or 40 and cannot be checked by any remedies yet found. I believe that society is here confronting a problem too difficult for any wisdom yet existent.

This is not pessimism but rather an opinion in the light of a distilled wisdom in socio-psychological matters; Cabot (4) would encourage to the utmost all studies in classification (as an approach to individualization), individualization in treatment and character diagnosis without making extravagant claims for the results.

Without regard to the tables and other statistical material presented in the text the data is believed to be reliable, accurate, and uniform as far as it goes. They are somewhat crude, especially as regards a scientific standardized classification and definition of a great many offenses. Many of the terms in use for military and other offenses are loosely applied and have little social or scientific significance. In this connection, speaking of criminology generally, Pollock (5) has said: "The lack of a standard classification is the primary obstacle in the way of good statistics in criminology." In many particulars the data is meager, but the number and type of courts martial held, the convictions and the disposal of the offenders with respect to imprisonment and dishonorable and bad-conduct discharges is available. To some extent the effects of probation on the persons convicted by courts martial can be studied. But recidivism in the naval service cannot be presented statistically with the information at hand.

Pollock (5) has likewise said:

The special function of statistics (in any branch of sociology) is to assemble the facts that must be dealt with and array them in an orderly, systematic fashion so that their meaning and interrelations may be readily comprehended.

* * * Without good statistics little social progress is possible.

A more thorough knowledge of the variables in causation of naval delinquency which could be brought out statistically would undoubtedly be of great value in a treatment program based on a knowledge of criminogenesis. A considerable degree of excellence has been obtained in an analagous matter by the Bureau of Medicine and Surgery. In the annual reports of the Surgeon General con-

cerning statistics of diseases and injuries in the United States Navy, diseases are reported by occupations, ages, and ratings, injuries by types of causative agents with division into naval and military hazards. This clearly facilitates a proper evaluation of much of the morbidity. Thus it is believed that an analysis of disciplinary matters into groups such as ages, ratings, total service, number, frequency and nature of prior offenses, and classification of the offenses as naval and military offenses, or as offenses common to society in general, would be equally helpful in the treatment of naval delinquency. Such a statistical program is believed to be essential to future progress.

The number of courts martial.—The scope and trend of delinquency in the Navy during the years 1930–35 is shown in tables 1 to 4, which follow below. For this 6-year period table 1 shows a total of 5,595 general courts martial; table 2 shows a total of 37,207 summary courts martial; table 3 shows a total of 25,560 deck courts. Impressive is the grand total of 68,362 courts martial of all types for the 6 years. The first inspection of the tables shows a steady reduction in the annual number of each type of court martial from 1930 to 1935. The reduction from 1,678 general courts martial in 1930 to 400 in 1935 is indeed striking. Likewise the reduction from 7,428 summary courts martial in 1930 to 3,971 in 1935 and the reduction from 5,364 deck courts in 1930 to 3,182 in 1935 are striking. Moreover, these reductions are fully corroborated in table 4 which is the percentage of enlisted men in the naval service tried by courts martial. As can readily be seen, this table relates the courts martial for each year by number, percentage, and type to the average enlisted strength of the Navy or Marine Corps, as the case may be. In 1930, for example, 13.18 percent of men in the Navy were tried by all types of courts martial and in 1935 only 7.13 percent were so tried. In 1930, 17 percent of the Marine Corps enlisted personnel were tried by all types of courts martial and in 1935 only 10.61 percent were so tried. Study of the tables clearly shows the incidence and recent trends in naval delinquency. Space does not permit a discussion of each item but the reasons for the definite and striking reductions will be subsequently considered.

It would seem timely to compare here the number and percentage of naval personnel with the civilian population as to court trials. In 1934 in Massachusetts (6) 219,153 defendants appeared before the courts; 198,706 of these were tried before the lower courts and 20,447 before the superior courts. With a 1934 population in excess of 4,249,614 (which were the figures of the 1930 census for Massachusetts), 219,153 defendants before the criminal courts approximates

TABLE 1.—General court-martial cases during fiscal years, 1930-35

[Compiled from the annual reports of the Judge Advocate General of the Navy]

Fiscal year	Officers		Enlisted men		Total
	Navy	Marine	Navy	Marine	
1930.....	62	16	1,181	419	1,678
1931.....	36	17	866	399	1,318
1932.....	48	5	692	267	1,012
1933.....	27	3	457	164	651
1934.....	29	4	392	111	536
1935.....	28	1	261	110	400
Total cases.....	230	46	3,849	1,470	5,595

TABLE 2.—Summary court-martial cases during fiscal years, 1930-35

[Compiled from the annual reports of the Judge Advocate General of the Navy]

Fiscal year	Navy	Marine	Total	Fiscal year	Navy	Marine	Total
1930.....	6,058	1,370	7,428	1934.....	4,352	950	5,302
1931.....	6,252	1,565	7,817	1935.....	3,100	871	3,971
1932.....	5,387	1,205	6,592	Total cases...	30,197	7,010	37,207
1933.....	5,048	1,049	6,097				

TABLE 3.—Deck court-martial cases during fiscal years, 1930-35

[Compiled from the annual reports of the Judge Advocate General of the Navy]

Fiscal year	Navy	Marine	Total	Fiscal year	Navy	Marine	Total
1930.....	4,100	1,264	5,364	1934.....	2,836	743	3,579
1931.....	3,728	1,186	4,914	1935.....	2,455	727	3,182
1932.....	3,476	1,012	4,488	Total cases...	19,763	5,797	25,560
1933.....	3,168	865	4,033				

TABLE 4.—Percentage of enlisted men in the naval service tried by courts martial

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Fiscal year	Service	Average number men under naval jurisdiction	Tried by general courts martial during year	Percent tried by general courts martial during year	Tried by summary courts martial during year	Percent tried by summary courts martial during year	Tried by deck courts during year	Percent tried by deck courts during year
1930.....	Navy.....	85,270	1,181	1.38	6,085	7.10	4,100	4.70
	Marine.....	17,885	419	2.34	1,370	7.60	1,264	7.06
1931.....	Navy.....	82,564	866	1.05	6,252	7.55	3,728	4.36
	Marine.....	16,724	399	2.39	1,565	9.36	1,186	7.09
1932.....	Navy.....	80,711	692	0.86	5,387	6.70	3,476	4.31
	Marine.....	16,093	267	1.66	1,205	7.49	1,012	6.29
1933.....	Navy.....	80,735	457	0.57	5,048	6.25	3,168	3.92
	Marine.....	15,200	164	1.08	1,049	6.90	865	5.69
1934.....	Navy.....	78,260	392	0.50	4,352	5.56	2,836	3.62
	Marine.....	14,992	111	0.75	950	6.34	743	4.95
1935.....	Navy.....	81,510	261	0.32	3,100	3.80	2,455	3.01
	Marine.....	15,981	110	0.61	871	5.45	727	4.55

5 percent very closely. In 1934 there was an average of 93,252 enlisted men of the Navy and Marine Corps under naval jurisdiction during the year and these men furnished defendants in 503 general courts martial and 8,881 inferior courts martial, a total of 9,384 courts martial which approximates 10 percent very closely. The nature of the offenses, however, are widely divergent; the offenses of those under naval jurisdiction include many minor offenses against discipline which would never come to trial under civil courts. Further, in the general population, the age factor is important with many who are incapable by youth or old age from committing crime; whereas the naval personnel is a selected group of young men.

Types of offenses.—The questions which arise next have to do with the special features of offenses in the naval service. Tables 5, 6, and 7 which follow below enumerate these offenses. Table 5 shows a list of the principle offenses committed by officers during the years 1930–35. Drunkenness, by far the most common, was present 120 times out of 410 offenses or 29.3 percent. Next in frequency were 74 offenses or 18 percent charged as conduct to the prejudice of good order and discipline, while the third offense as to frequency was absence without or over leave, which occurred 39 times or 9.5 percent of the total offenses. These three offenses alone account for 233 or 56.8 percent of the total of 410 offenses in officers. Negligence in hazarding or stranding a vessel, which looms large in wardroom stories of disaster to the careers of naval officers, occurred only 6 times or 1.46 percent of the offenses for the 6-year period.

TABLE 5.—*Schedule of principal offenses of officers tried by general courts martial during the fiscal years 1930–35*

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Offenses	Navy	Marine	Total
Absent without or over leave.....	30	9	39
Conduct to prejudice of good order and discipline.....	57	17	74
Conduct unbecoming an officer and gentleman.....	27	8	35
Culpable inefficiency in performance of duty.....	9	1	10
Desertion.....	4	0	4
Disobedient or disrespectful to superior officer.....	8	0	8
Drunkenness.....	94	26	120
Embezzlement of money or property and fraudulent claim.....	12	0	12
Falsehood.....	11	2	13
Neglect of duty.....	11	3	14
Negligence in hazarding or stranding a vessel.....	6	0	6
Scandalous conduct to destruction of good morals (other than lascivious).....	21	6	27
Scandalous conduct (lascivious).....	1	1	2
Violation of lawful regulation issued by Secretary of the Navy.....	28	3	31
All other offenses (miscellaneous).....	14	1	15
Total offenses.....	333	77	410
Acquitted (totals only).....			82
Disapproved, nolle prossed or set aside (totals only).....			17
Total charges preferred.....			509

TABLE 6.—Schedule of principal offenses of enlisted men tried by general courts martial during the fiscal years 1930–35

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Offenses	Navy	Marine	Total
Absent without or over leave.....	484	176	660
Assault (all grades) and striking other persons.....	164	84	248
Breaking and resisting arrest.....	193	49	242
Conduct to prejudice of good order and discipline.....	170	138	308
Desertion.....	2,443	779	3,222
Disobedient or disrespectful to superior officer.....	58	21	79
Drunkenness.....	211	150	361
Embezzlement, theft, stealing, or fraud (property).....	172	94	266
Falsehood.....	43	10	53
Neglect of duty and negligence.....	19	18	37
Scandalous conduct to destruction of good morals (other than lascivious).....	178	84	262
Scandalous conduct (lascivious including sodomy, 8 cases).....	85	14	19
Violation of lawful regulation issued by Secretary of the Navy.....	64	25	89
All other offenses (miscellaneous).....	214	148	362
Total offenses.....	4,498	1,790	6,288
Acquitted.....	201	99	300
Disapproved, nolle prossed or set aside.....	68	32	100
Total charges preferred.....	4,767	1,921	6,688

TABLE 7.—Schedule of principal offenses of enlisted men tried by summary and deck courts martial during the fiscal years 1930–35

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Offenses	Navy	Marine	Total
Abusive, obscene, profane, threatening, or provoking words or language.....	778	236	1,014
Embezzlement, theft, stealing, and misappropriation.....	1,127	383	1,510
Asleep on watch.....	851	665	1,516
Assault, attempts to strike, striking, et al.....	1,002	266	1,268
Absence without or over leave.....	33,622	6,564	40,186
Drunkenness.....	6,610	2,132	8,742
Conduct to prejudice of good order and discipline.....	2,917	963	3,880
Breaking arrest.....	1,243	137	1,380
Leaving station before being regularly relieved.....	789	480	1,269
Missing ship.....	2,026	190	2,216
Destroying, damaging, or wasting property.....	1,095	666	1,761
Disobedience, negligence in or refusing to obey.....	3,411	1,330	4,741
Disrespectful to superior officer.....	989	267	1,256
Falsehood.....	868	160	1,028
Gambling.....	401	63	464
Scandalous conduct.....	264	65	329
Violation of general order, Navy regulation, postal regulation, U. S. Criminal Code, or other statutes.....	2,721	635	3,356
All other offenses (miscellaneous).....	12	2	14
Total offenses.....	60,726	15,204	75,930

Table 6 shows 6,288 offenses of enlisted personnel tried by general courts martial in the 6-year period. Of this number desertion occurred 3,222 times or 51.24 percent of the total, while absence without or over leave was the second most frequent offense, occurring 660 times or 10.5 percent. Drunkenness, the third most frequent offense resulted in 361 offenses or 5.74 percent of the total. Combining these three offenses the total is found to be 4,243 or 67.49 percent of all the offenses of enlisted men tried by general courts martial.

Table 7 shows 75,930 offenses tried by summary courts martial and deck courts martial during the 1930–35 period. Of these 40,186 or

52.9 percent were for unauthorized absence (absence without or over leave). While not shown in the table this unauthorized absence was over 10 days in 3,045 cases and under 10 days in 37,141 instances. Drunkenness, the second most frequent offense, resulted in 8,742 offenses or 11.5 percent. The third offense in frequency was disobedience, negligence in obeying, or refusal to obey a lawful order; 4,741 instances of this offense occurred or 6.2 percent of the total. Again combining these three principal offenses we find a total of 53,669 offenses or 70.7 percent of the total of 75,930.

Celerity and certainty of justice.—Trial by naval courts martial as a rule quickly follows preferment of charges and justice is not thwarted by unseemly delay. Moreover, it would appear that the percentage of convictions is high. This is dependent in part upon the methods of investigation prior to preferment of charges, and in part upon the type of offenses, which are in the main easily proved. The reporting officer, the executive and commanding officers, and their aides make an investigation prior to ordering the offender tried. Unless a clear case exists, especially for minor offenses, the commanding officer awards punishment or a warning and the case is dropped. In the matter of convictions tables 8, 9, and 10 which follow show the final actions of general and inferior courts martial for the 6-year period. Thus, of 5,595 general courts martial for the years 1930-35 there were 5,336 convictions or 95.4 percent finally approved by the Navy Department. This compares to 10,544 total convictions or 51.66 percent out of 20,447 criminal prosecutions in the superior courts of Massachusetts for the year 1934. Table 9 shows that 37,207 summary courts martial resulted in 36,046 or 97.42 convictions; of 25,560 trials by deck court, 25,318 or 99.05 percent resulted in convictions as shown in table 10. Combining these two series of trials by inferior courts martial it is found that of 62,767 trials there were 61,363 convictions or 97.76 percent. This compares to 122,409 convictions or 61.6 percent of 198,706 criminal prosecutions in the lower courts of Massachusetts for the year 1934.

TABLE 8.—Final action by Navy Department on general courts reviewed during the fiscal years 1930-35

Final action	Officers, Navy and Marine	Enlisted men		Total
		Navy	Marine	
Convictions approved.....	230	3,702	1,404	5,336
Convictions disapproved or set aside.....	10	32	9	51
Convictions approved in part, disapproved or set aside in part.....	6	17	15	38
Acquittals approved.....	27	84	35	146
Acquittals approved in part, disapproved in part.....	2	8	5	15
Acquittals disapproved.....	1	6	2	9
Total.....	276	3,849	1,470	5,595

TABLE 9.—Final action by Navy Department on summary courts-martial cases reviewed during the fiscal years 1930-35

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Final action	Navy	Marine	Total
Bad-conduct discharges remitted on probation.....	4,874	712	5,586
Bad-conduct discharges executed.....	5,954	1,318	7,272
Other cases.....	18,411	4,777	23,188
Total convictions approved.....	29,239	6,807	36,046
Acquitted.....	632	137	769
Disapproved, nolle prossed, or set aside.....	326	66	392
Total cases reviewed.....	30,197	7,010	37,207

TABLE 10.—Final action by Navy Department on deck courts reviewed during the fiscal years 1930-35

[Compiled from the annual reports of the Judge Advocate General of the U. S. Navy]

Final action	Navy	Marine	Total
Convictions approved.....	19,576	5,742	25,318
Cases disapproved, nolle prossed, or set aside.....	71	21	92
Acquitted.....	116	34	150
Total records received and reviewed.....	19,763	5,797	25,560

Sentences and probation.—What happens to the individuals convicted? What are their sentences? Of 276 officers tried by general courts martial during the 6-year period 230 were convicted. Of these 117 received sentences involving loss of numbers, 56 were dismissed from the naval service, and 12 were sentenced to dismissal and imprisonment, while 18 were fined and 19 received miscellaneous sentences including loss of seniority, loss of pay, and restriction.

Convictions were approved by the Navy Department in 5,106 trials of enlisted men by general courts martial. It is difficult to arrive at safe criteria as to sentences but imprisonment must have been awarded in a very high percentage of cases. For example, information is available that a total of 5,027 general court-martial prisoners were received during the period 1930-35 for confinement in naval prisons, at receiving ships, stations, and barracks. Of this 5,027 it is also known that 3,622 were confined in naval prisons. During the same period figures show that general court-martial prisoners were disposed of by dishonorable discharge in 3,219 instances and by bad-conduct discharges in 1,100 instances. Other information regarding sentences is too meager to permit inferences.

Table 9 shows that of the 36,046 summary courts-martial convictions 7,272 offenders were discharged by bad-conduct discharges pursuant to sentences of the court and 5,586 bad-conduct discharges were remitted on probation. In the remaining 23,188 convictions it must be inferred that the sentences involved fines, reduction in rating, or

other appropriate legal punishment. There are no figures given but it may be safely presumed that of the 25,318 deck-court convictions more than 90 percent received fines.

Probation as used in the naval service may be defined (secs. 742 and 743, Naval Courts and Boards) as the process by which the reviewing authority suspends execution of the sentence and places the person convicted of the offense upon his good conduct with a view to reformation. For the period of probation the sentence is conditionally remitted in lieu of being summarily executed. The probationary period cannot extend beyond the current enlistment of the probationer. Any conditionally remitted sentence, upon expiration of the designated period of probation or upon discharge from the naval service, becomes unconditional without further action.

No record is available of probation for deck courts during the period studied. However, in 5,586 summary court-martial sentences involving a bad-conduct discharge the offender was placed on probation. No record is available for other types of probation in summary courts martial, although every officer of experience knows that many sentences involving fines, reduction in rating, and other sentences were conditionally remitted. In the 5,586 summary court-martial probationers of whom we have record, 3,417 or 61.17 percent were successful in serving out the period of probation and thereby earning remission of the sentence of a bad-conduct discharge. On the other hand 2,169 or 38.83 percent were unsuccessful during the probation period and in these cases the sentences of discharge from the Naval Service with a bad-conduct discharge were executed. This 2,169 plus the 7,272 discharges immediately executed gives a grand total of 9,441 bad-conduct discharges as a final result in 36,046 summary court-martial convictions.

During the 1930-35 period, in 503 instances of general courts-martial sentences involving confinement the sentence was held in abeyance on probation. Of these 503 general court-martial probationers, 328 or 65.2 percent were successful in completing their period of probation and 175 or 34.8 percent were unsuccessful. The percentage of success under probation in the Navy does not necessarily depend upon the type of court martial, which is in turn an index to the character and seriousness of the offense. The differences cannot be regarded as significantly favoring the general court-martial prisoner for probation rather than the offender tried by summary court martial. Factors of selection are definitely indicated when it is known that of 5,106 general court-martial prisoners, 503 or 9.85 percent were placed on probation, whereas of 36,046 summary court-martial convictions 5,586 or 15.5 percent were placed on probation.

Conditioning factors in naval delinquency.—We are far from the goal of exact and final knowledge in the matter of causation and treatment of crime and delinquency. There is no single, constant, invariable etiological factor in any crime or criminal, delinquency or delinquent. Nevertheless, we may systematically pursue the subject of causation with profit. For delinquency, in common with other social, psychological, and biological phenomena, may be prevented and controlled without full and perfect knowledge of etiology. With approximate concepts of causation an empirical program of treatment and prevention, controlled by scientific observation, may be outlined. The history of medicine is replete with examples of the success of such programs. The elimination of scurvy, the eradication of smallpox, the control of yellow fever, and the improvement in the treatment of the mentally ill are cogent examples.

Healy (7) has well summarized the factors in causation as follows:

When we attempt to assay the part that constitution or the personality, as these may be defined in any terms, play in the production of delinquency and crime, we are faced by the necessity of taking into account the main classes of variables which are known to be effective in producing antisocial conduct. These are: (1) The physical and mental equipment of any given individual as it may exist at any time; (2) the formative life experiences of the individual; (3) the formed reactive tendencies of the individual—mainly to be thought of as elements of ideational life, emotional tensions, and habit formation; (4) the environmental influences and social pressures which have been active recently, prior to or at the immediate time of the commission of delinquency and crime.

The interweaving and permutations of these variables and their many components create a tremendous body of factual material which we discover if we attempt scientifically to weight the factor of constitution or personality and answer the main question: Who are delinquents and criminals and what are they?

Biological.—Modern attempts to differentiate the criminal from the noncriminal by other than the criminal act began with Lombroso in 1876. Much as we are indebted to him for his insistence upon study of the individual we may dismiss his concept of the relationship between the criminal and human degeneracy. Goring's great work proved the inadequacy of the idea that the criminal is generally a stigmatized individual biologically. This has been further substantiated by the work of American criminologists, notably Healy. In general, criminality is not biological destiny.

Men in the naval service are physically selected with a view toward the elimination of the biological unfit. Nor is it to be supposed that the delinquent differs physically from his fellows in regard to body-build, height, weight, nutrition, and similar physical categories. The impression has long been held by officers of experience

that delinquents in the naval service more often have a venereal record than nondelinquents. Haile (8) in a study of 115 men, the crew of a destroyer, found that 59 or 51.3 percent had a venereal history and 56 or 48.7 percent had no venereal history; the venereal group had 58 mast reports entered on their current records compared to 12 mast reports on the current records of the nonvenereal group; in the venereal group 2 received bad-conduct discharges, 1 received an undesirable discharge, and 3 deserted, while none of the nonvenereal group in the 6-month period were so involved.

Mental disorder and mental defect.—We recognize two diverse streams of thought in regard to the influence of mental disorder and mental defect as a conditioning factor in delinquency. On the one hand we cannot in general think of the offender as some sort of differentiated individual. Our common-sense attitude toward motivation and circumstance is in many instances a good one:

There but for the grace of God were I since I have had the same impulses and done the same things.

Moreover, we know of the enormous number of laws and ordinances and realize with Warner (9) that—"it is a rare individual who has not committed during his lifetime some minor infraction of law or ordinance, and many persons commit crimes without realizing it." Aware of the wide range of thinking, conduct, and behavior which is sanctioned by society we are reluctant to label as pathological any of the occasional or minor variations from it. Yet the concept of the differentiation of the delinquent from the nondelinquent on the basis of mental deviation has gained wide acceptance in this country. The psychiatric viewpoint and work of White, Glueck, Healy, and others has profoundly stirred the imagination and evoked the interest and sympathy of hundreds of eminent educational, religious, and sociological leaders.

The relation of mental disorder and mental defect to naval delinquency has in years past and principally in this Bulletin been considered by Butts, Schier, Sheehan, G. E. Thomas, Jacoby, Stearns, and Crosby (1, f and g). For the period of this study the number of men discharged (invalided) from the naval service by reason of mental deficiency ranged from a high of 6 in 1930 to a low of 3 in 1934. In the latter year (1934) a total of 1,633 persons were invalided from the service, diseases of the mind being responsible for the invaliding in 264 instances or 16.17 percent. In 1930, of 2,041 persons invalided from the service, 360 or 17.64 percent were for diseases of the mind. In the annual reports of the Surgeon General, United States Navy, it is recognized and repeatedly stated that personnel subject to wide emotional fluctuations and mental defect are often incapable of meeting their responsibilities and prop-

erly performing their duties and that, as a class they contribute to "frequent violations of disciplinary requirements" (1934, p. 127). In addition to the frank and committable insanity, military psychiatry constantly deals with disease and disorder, medically mild but militarily most insidious.

Whatever role we may assign to mental disorder and mental defect in the causation of naval delinquency we must be prepared, as psychiatrists, in any putative case to answer the questions in terms of known tests, classification, and etiological factors, namely: Mental deficiency, syphilis, epilepsy, alcohol, other organic disease of the central nervous system, exhaustion, dementia precox, manic-depressive psychoses, psychopathic states, or psychoneurotic reactions. Every psychiatrist of experience and every naval psychiatrist who has written on the subject has emphasized the importance of the prepsychotics, psychopaths, and the psychoneurotics who are so frequently discharged under the categories of inaptitude, undesirable, not recommended for reenlistment, bad-conduct discharge, and dishonorable discharge. These are the troublesome problems. The typical and certifiable psychotic seldom gives much trouble in diagnosis or disposition.

Age.—As a conditioning factor in crime and delinquency age is an important item. Every individual passes through certain natural biological phases of life and these often exert a marked influence on his behavior. Numerous observers have reported that confirmed criminals begin their careers in childhood and early youth. According to census figures the average age of the prisoner today is 23 years. Forty percent of those apprehended for crime in the United States last year were in their nineteenth year; Squire (10) says, "there were more in their nineteenth year than in any other age group." In a group of 200 naval prisoners Crosby (1, g) found the average age to be 23 years and 3 months.

Delinquency, civil and military, is preponderately a phenomenon of youth. What, then, do we know of the ages of naval personnel? On July 1, 1934, 34,675 or 42.92 percent of the enlisted strength of the Navy and 58.36 percent of the enlisted strength of the Marine Corps were in the age groups below 24. This compares to 47,343 or 55.05 percent of the men in the Navy and 12,357 or 68.55 percent of marines below the age of 24 on July 1, 1929. Study of the quinquennial age group tables in the annual report of the Surgeon General, United States Navy, for the 1930-35 period results in three conclusions: (1) The enlisted personnel of the Navy and Marine Corps are in the main young men; (2) the Marine Corps enlisted personnel are definitely younger than the enlisted personnel of the Navy; (3) during the period of this study the age of the men of the Navy and

Marine Corps increased perceptibly because of an increasing percentage of reenlistments. Though figures as to the ages of offenders against naval and military discipline are not available common opinion holds that the young are the ones who transgress most often. From table 4 we can easily see that the Marine Corps enlisted personnel, definitely younger than the Navy enlisted personnel, have a higher percentage of courts martial in each category and for each year. The striking decrease in the number of courts martial generally during the years 1930-35 may be explained in part by the increasing age of the personnel. For example, the percentage of enlisted Navy and Marine personnel below the age of 24 was 59.45 percent in 1929 while in 1933 it was only 44.87 percent. In addition the factors of service selection as the men grow older they face life with more seriousness and more maturity. The maturational mechanisms operate as stabilizing factors underlying personality. Motives and impulses change and become sobered, the scale of values become patterned.

Recruiting and the supply of men.—Closely allied to the biological, physical, mental, and social factors in the causation of naval delinquency is the problem of recruiting. The number of men originally enlisted in the Navy since 1922 has varied from 29,113 in 1923 to 6,320 in 1933; the former number constituted 36.4 percent of the applicants for enlistment and the latter number constituted only 5.8 percent of the applicants for enlistment. In other words, of 79,980 applicants in 1923 it was necessary to accept 29,113 in order to obtain the desired number of men while in 1933 of 108,965 applicants it was necessary to accept only 6,320 men. We may safely presume that the economic condition of the country has affected the supply of men. With a much greater supply of men to choose from and a smaller number of vacancies (because of a greatly increased number of reenlistments) it follows that higher qualifications were enforced for the selection of men for original enlistment. There is plenty of statistical evidence to prove the point which has often been made in recent years that the Navy is enlisting a much higher caliber and type of men. The social-educational-occupational background of the candidate for enlistment has been investigated; many high-school graduates and some with a year or two in college have enlisted in the Navy and Marine Corps. The quality of the men obtained has been reflected, from the physical standpoint, in the reduction of the number of men invalided from the service soon after original enlistment. For example, of 14,361 men enlisted in the Navy in 1928 there were 716 or 5 percent invalided from the service within 12 months after enlistment on account of disability existing prior to enlistment, whereas of 6,320 original enlistments in 1933 only 92 or 1.5 percent were invalided within 12 months. This is an im-

portant index to the high quality of men recruited; the delinquency rate is undoubtedly of like significance, and the steady reduction of delinquency a consequence, at least in part.

Turn-over of personnel.—Closely associated with the factors of age and recruiting as conditioning variables in naval delinquency is the factor of personnel turn-over. This is constantly taking place both within the service and between the service and the civilian population. Replacement of men transferred from one activity to another results in turn-over which affects an organization, and replacement of men discharged from the service, through expiration of enlistment or for any other reason, with men from civil life constitute turn-over which affects the service at large. It is to be presumed that a high rate of turn-over is one of the factors in delinquency. It has been clearly shown that a high rate of turn-over is one of the prominent causes of high morbidity rates, particularly for communicable diseases. The stability of personnel, both within the service as a whole and within individual units, which is synonymous with small turn-over, is an important factor in discipline and morale. As every experienced officer knows, the ship or station with small turn-over usually has few disciplinary problems. Moreover, men with short total service are most often in trouble. Studies by Jacoby, Stearns, and Crosby (1, d, f, and g) have shown that the majority of prisoners in the naval prison at Portsmouth have less than 3 years' naval service; thus, the average service of 177 deserters was 1.5 years.

Social factors.—The social and biological tensions of personnel in the naval service which have meager outlet may find expression in aggressive behavior which easily takes the form of delinquency. Emulatory attitudes on the part of others lead them to follow. When once entered on the path of delinquency adventitious forces often keep the individual on it. There enters also the question of the unity, oneness, and coherence of the group and solidarity as to class. In 1934 some 17,134 youths were originally enlisted in the Navy and Marine Corps. They came from all sections of the United States, from various economic classes, from the farms and from the cities, from all the races that make the melting pot of this country, from all religions. Each year a greater or less number are dislocated from home and community and thrust into a new, strange, and mobile environment. The naval service must assimilate them and stimulate them with the sentiment of self-regard and group solidarity. Many men feel the opportunity the break from home ties gives for liberty and license. If long continued, such an attitude leads inevitably to delinquency.

Delinquency is a function, biologically conditioned, of these sociopsychological factors and varies with the degree of integration of

the individual with the group to which he belongs. The setting or environment in which delinquencies occur has proved of tremendous importance in many studies. In the Navy the influence of established groups moves for better or worse kinds of behavior, temptations, special opportunities for misconduct, as well as variations in social pressures, institution and group attitudes as part of the special service environment cannot here be properly evaluated. Nevertheless these social factors have great weight.

CONCLUSIONS

1. This preliminary study of delinquency for the years 1930-35 seeks to erect a base line showing the incidence and recent trends against the background of the United States Navy and within the framework of naval law.

2. For the 6-year period there were 5,595 general courts martial, 37,207 summary courts martial, and 25,560 deck courts, or a grand total of 68,362 courts martial of all types.

3. There has been a steady annual reduction, absolute and relative, of the total number of courts martial as well as each type of court martial. For example, in 1930 there were 14,470 courts martial and only 7,553 in 1935.

4. A greater percentage of enlisted Marine Corps personnel are tried by courts martial than Navy enlisted personnel. For example, courts martial in 1930 were 17 percent marines against 13.18 percent Navy and in 1935, 10.61 percent Marines against 7.13 Navy.

5. Convictions resulted in 5,336 or 95.4 percent of 5,595 general courts martial, in 36,046 or 97.42 percent of 37,207 summary courts martial, and in 25,318 or 99.05 percent of 25,560 deck courts. This affirms in figures the policy of the Navy Department "not to initiate court-martial proceedings against persons in the naval service unless there is a reasonable belief that the trial will result in conviction" (C. M. O. 9-1936, p. 10).

6. The biological endowment, mental disorder, and mental defect, age, recruiting and the supply of men, personnel turn-over and special environmental and social factors have each in their turn been considered as conditioning naval delinquency. We may fairly say that delinquency is not biological destiny. Then, if delinquents and criminals are made and not born, the process of making assumes critical significance. The clues which we have followed have been elusive, but they indicate something of the dynamic setting and pattern of delinquency in the Navy.

7. The statistical method in the study of psychiatric-social factors in naval delinquency should lead to a better and more fundamental understanding of the relation of these factors and of the problem as a whole.

8. The mentally abnormal individual is frequently in conflict with naval law and in many instances his abnormality becomes an issue after delinquencies. In such cases repeated minor infractions of discipline are of equal or greater significance than a single major offense. Those who transgress the law should be treated as social problems. The psychiatric aspect of any putative case can be handled within the present structure of lawful procedure. Nor does this imply in any sense the relinquishment of unpleasant forms of dealing with offenders.

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IMMUNITY IN SYPHILIS

By C. S. BUTLER, Rear Admiral, Medical Corps, United States Navy

The Navy experience with primitive syphilis in Guam, combined with that of Ellis H. Hudson (1) in Mesopotamia and that of Delic and Grin (2) in Bosnia shows us how little we actually know about inherited syphilis. For years we have lulled ourselves with the teach-

ing handed down to us that if there was no gross evidence of syphilis and a negative Wassermann there was nothing for the individual to worry about. So far as I know there is no way to unmask latent syphilis. We know that inherited syphilis may exist for many years in a state of latency and then develop into one or other of the symptom complexes we recognize as always due to syphilis.

Based on the presence or absence of the initial lesion we may say there are two types: (1) those showing initial lesions and (2) those not showing them. Each of these may in turn be divided into two and we may tabulate them thus:

A=With demonstrable chancre—	{1. Venereal.
	{2. Non-venereal.
B=Without demonstrable chancre—	{3. Acquired.
	{4. Inherited.

Let us look at these four varieties with a view to ascertaining the relative importance of each.

1. Osler and McCrae, 12th edition, p. 257, state: "It must be emphasized that infection may occur without any marked primary lesion which may be only a superficial erosion or ulceration. A negative history as to the occurrence of a chancre is of no value in excluding infection." As far as the history is concerned this is perfectly correct. But to us physicians the actual occurrence of a chancre is one of the most, if not the most important symptom in venereally acquired syphilis. A young man applies to you highly despondent and says he fears he has syphilis though he has never transgressed but once in his life. He remembers the exact day and hour of this transgression and says he now has an eruption on his body. Upon inquiry about the initial lesion and upon inspection it develops that he has had none. You then look at his eruption, being almost sure that whatever it is due to it will be found not to be syphilitic. In my experience the number of cases occurring without a genital chancre is negligible.

2. Let us take the acquired syphilis resulting from an innocent infection. A young woman is brought to your office with an indurated sore on her lip. It is painless and there is an enlarged node under the mandible on the side of the sore. You enquire about her history feeling assured she has kissed some one with mucous patches or a chancre about the lips. If she tells the truth you can usually confront her with the person who infected her. But how about innocent chancres among primitives of all races. This type of chancres is vastly in the majority and yet the history as secured from the people of this class is almost if not quite useless. Such people never treat their lues and an infectious eruption may follow this lesion in

from 20 days to 20 years. It is this type of history that gives to so-called yaws its single and only peculiarity.

B. Without demonstrable chancre.

3. *Acquired.*—This is rare if indeed it ever occurs. We are all apt to run to the “authorities” for information about acquired syphilis without a chancre. Recall our individual experiences and we have something better than any authority can give us. Either the patient is lying, or his chancre too small to be noticed by him, or he was too stupid for it to impress him. For the normal man who will diligently inspect after a doubtful intercourse, and who will tell the truth, history of a venereal chancre can practically always be elicited. If it is not elicited, then we must have the most certain substantiating evidence before we diagnose syphilis.

4. *Inherited.*—Governed by the laws of Colles—a syphilitic child born of a healthy mother may nurse its mother without infecting her, and of Profeta—a healthy child born of syphilitic parents is immune. It is apparent that the Colles mother and the Profeta child may and in all probability do have latent syphilis. It is also apparent that all grades of infection, up to the point where the child has lost all immuno-resistance and is a “candidate” for acquired syphilis, may be its inheritance from syphilitic parents. With any people who do not treat syphilis, all in course of time will inherit the taint. This is a self-evident fact and as true as are the laws of Colles and Profeta. If we accept Chesney’s assertion that there is an actual immunity in syphilis, and Stokes’s that immunity may depend upon the actual presence of *T. pallidum*, then we may understand the infinite variety of combinations of these two which may occur in the offspring of syphilitic parents. If we take the vowels a, e, i, o, and u as representing decreasing quantities of antigen (*T. pallidum*) in the new-born, “u” representing its complete absence, and the consonants B, C, D, F, and G as representing the amount of immunity the child has at birth, “G” representing its complete absence, we may visualize some of the possibilities in store for a new-born baby among primitives who never treat. A father with “e B” taint begetting a child with a mother having “u F” taint might easily transmit an “u G” taint which would make the child susceptible to acquired syphilis. On the other hand there may be abundant antigen in the child but no immunity in which case the offspring would come down early with symptoms of inherited syphilis. Finally we may conceive of a setup which may be represented by “u B” or in other words considerable immunity with no treponemata present to stimulate greater immunity. Such an individual would not acquire syphilis until his immunity transferred at birth was lost or reduced.

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PRESENT-DAY CONCEPTS OF ENDOCRINOLOGY

By PAUL F. DICKENS, Lieutenant Commander, Medical Corps, United States Navy, and
OMAR J. BROWN, Lieutenant, Medical Corps, United States Navy

PART II—(CONTINUED FROM JANUARY ISSUE)

As was stated before of the 16 functions attributed to the pituitary, there are six hormones which apparently have been definitely distinguished. Up to the present, we have discussed two of these six, the gonadotropic and the lactogenic hormones of the anterior portion. We shall now proceed to consider the other four; the growth, the thyrotropic, the adrenotropic, and the pancreotropic.

THE GROWTH HORMONE OF THE ANTERIOR PITUITARY GLAND

Postnatal development, particularly observable in skeletal growth, is governed by endocrine substances, the most influential of which are elaborated in the pituitary, the thyroid and the gonads; the contribution of other glands being less important.

The effects of the three main glands vary according to the stage of life. The thyroid is paramount in early prenatal life. Somewhat later, the pituitary assumes the leading role and continues to hold it until skeletal development is completed. The effects of gonadal activity stand out during the period of immediate prepuberty and adolescence. In this connection it is interesting to note that as the gonadal or sex hormones attain their full physiological effect the growth of the individual gradually ceases. All three glands reciprocally influence each other, and their combined action in physiological harmony results in normal development. Therefore, it seemingly is due to the harmonious action of the endocrine system, according to the fixed pattern, that average normal adults so closely approximate one another in growth development. Disturbance in the function of any one of these glands is usually followed by secondary changes in the function of the others, often to such an extent that it is difficult to determine which gland is primarily at fault. In fact, it may be said that not only are all of the ductless glands of the body members of the endocrine system, but also that they are disunited fragments of a glandular conglomerate.

Abnormalities of development due to glandular disturbances are divided into two groups: (a) stunted growth, due to an underproduc-

tion of the growth hormone and (b) excess growth, due to an overproduction of the growth hormone.

The first solid achievement of experimental research in the field of pituitary hormonology was the recognition of the growth hormone, although even yet its mechanism of action is not understood. Does it act directly on the widespread tissues of the body and cause them to grow, or are its effects indirect? That is, does it stimulate other glands such as the thyroid and thymus to overfunction? What is the mechanism of its action on general metabolism and particularly the proteins? These and many others are some of the questions yet to be answered.

Underproduction of the growth hormone (dwarfism).—Hypophysectomy in young animals, especially puppies, results in the production of dwarfism and infantilism. That these effects are due to the deficiency of the growth hormone is proved by the fact that growth can be revived in artificially dwarfed animals by the use of anterior pituitary extracts from which contaminating hormones—those influencing the thyroid, sex glands, and adrenals—are removed. The growth hormone, of course, must be administered before the union of the epiphyses.

It is not improbable that all forms of real dwarfism (to be distinguished from stunted growth due to such factors as malnutrition, richets, chondrodystrophy, the hypothyroid states, etc.), are directly caused by inadequate production of the growth hormone by the pituitary during the preadolescent stage of life regardless of any other factors involved. However, the most frequently seen cause of stunted growth is failure of the thyroid, either acquired or congenital, during infancy or the prepubertal period. This condition is easily recognized by roentgenograms which show delayed formation of the centers of ossification in the carpal and tarsal bones as well as of the epiphyses of the long bones.

If the hypothyroid child is allowed to develop without adequate therapy, growth may be inhibited to the point that it simulates real dwarfism. The thyroid dwarf is conspicuous for his short extremities while his trunk is comparatively well developed. X-ray findings during early childhood will furnish the diagnosis even in the absence of the generally accepted hypothyroid symptoms such as myxedematous skin, potbelly, enlarged tongue, or cretinism. Later in life, when ossification has been completed, the diagnosis must depend upon the disproportion between the body and the extremities. The absence of the thyroid hormone, thyroxin, must therefore prevent the full action of the growth hormone of the pituitary.

It must be emphasized that the hypothyroid stature ensues only if the thyroid deficiency prevailed before the termination of skeletal

growth. Hypofunction of the thyroid after this period can in no way influence skeletal proportions. Thus, one sees, not infrequently, hypothyroid individuals who are tall and have extremities of normal length.

Cretinic dwarfs, in contradistinction to hypothyroid dwarfs, are apparently the result of the depression of pituitary function due to thyroid insufficiency, and the restoration of their growth can be effected either by the administration of thyroid or by direct treatment with pituitary extracts. It is understood that thyroid therapy, in this condition, supplies the deficient thyroid principle and thus indirectly stimulates the pituitary to activity.

Pituitary dwarfs, so called in order to distinguish them from those described as due to hypothyroid function, are occasionally seen. In these cases the stunted growth is assumed to be due to a primary failure of the pituitary gland to manufacture the growth hormone. These individuals show a uniform lack of development, there being no real disproportion between the body and the extremities, and usually, but not invariably, there are associated other manifestations of pituitary dysfunction, such as obesity and infantile genitalia.

Clinically the group offers several differential diagnostic points which will separate it from the growth deficiency due to thyroid hypofunction. The hypothyroid person shows coarse features and is invariably homely. The hair is coarse and dry, dentition is delayed, the teeth poorly crowned, and X-ray pictures show delayed formation of centers of ossification in children, but normal ossification of the epiphyses in the adult. He is the "ugly duckling." The basal metabolic rate is low and the fat tolerance test shows a rise in the ketone bodies. However, genital development is normal.

The hypopituitary person shows the characteristic "doll-face" with pretty features. The hair is soft and silky, the teeth are excellent structurally though wide apart, and X-ray pictures show delayed epiphyseal ossification even in the otherwise fully matured dwarf. The basal metabolic rate is normal or low and the fat tolerance test shows no rise in the ketone bodies of the blood. The genital organs are frequently hypoplastic.

Progeria, or adrenal dwarfism, is another type of stunted growth occasionally seen. In addition to the atrophic changes present in the adrenals there is an associated pituitary deficiency. The condition, which may arise during childhood or later during adolescence, is characterized by a peculiar type of leanness and a senile appearance, the cause of which is not apparent.

From what has been said it is not difficult to see that the classification of human dwarfism is unsatisfactory at the present time. Doubtless all glands exert an influence on the pituitary; and the fact that

all functions of the pituitary are not equally depressed leads to much of the difficulty. For example, the growth and gonadotropic hormones may both be depressed so that we have a dwarf showing sexual infantilism. If the growth hormone alone is depressed and the gonadotropic hormone normal we get a dwarf with fully developed sexual characteristics. Naturally various degrees and combinations of these hormonal inadequacies can exist.

Deficiency of the growth hormone in adult life.—In adulthood the role of the growth hormone is obscure but it is certain that the hormone enters into the physiologic body mechanisms throughout life. Experimental work has demonstrated that the growth hormone is no more abundant in young calves than it is in adult cattle. By analogy, this fact is assumed to hold true for the human.

An interesting pathological condition associated with a hypopituitary state in the adult was reported by Simmonds in 1914 and bears his name—Simmonds' disease. The picture is one of progressive emaciation, asthenia, and cachexia. There are loss of teeth, pubic and axillary hair, and the appearance of smallness. Atrophy of the skin gives the appearance of senility. There are amenorrhea and sterility in the female, impotence and loss of sexual desire in the male. It represents, presumably, the effect of complete deprivation in adult life of all the anterior lobe hormones, since autopsy in these cases shows either complete destruction or sclerosis of the pituitary. That this condition is not due to absence of the growth hormone alone is attested by the fact that treatment with the growth hormone will cause tissue growth in this disease, yet the cachexia remains. Treatment with the crude anterior pituitary extract, a substance presumably containing all the hormones, will however, relieve all symptoms. That this condition has no affinities with Addison's disease is demonstrated by the fact that extracts of the adrenal cortex and sodium chloride have no effect.

Froelich's syndrome (*dystrophia adiposogenitalis*) is another pituitary involvement, of which the precise hormonal physiologic disturbance is today not known. It is usually stated that there is probably a state of hypofunction of both the anterior and the posterior lobes of the pituitary, the anterior lobe deficiency being more marked in the sexual than in the growth hormone. The obesity and the increased sugar tolerance are usually attributed to the posterior-lobe phenomenon. But it must be stated that to date only two hormones, oxytocin and pitressin, have definitely been isolated from the posterior lobe, and since neither of them has been separated in pure form, the one affecting carbohydrate metabolism is not known. A full understanding of this problem must await further investigation.

The picture differs from Simmonds' disease in that the cachexia is lacking, there is obesity instead of wasting and, as in hypophyseal dwarfism, there is infantilism. The typical syndrome develops during childhood or adolescence but an adult type, characterized by amenorrhea in women and loss of sexual desire and impotence in men, is seen.

The typical picture in the juvenile type is one of obesity, most marked about the pelvic girdle, genital infantilism, lack of development of the secondary sex characteristics such as unchanged voice in the male, failure of the uterus to develop in the female, short extremities, knock-knees, and frequently an increased sugar tolerance.

Overproduction of the growth hormone.—Overproduction of the growth hormone before maturity results in a symmetrical, well proportioned overgrowth called gigantism; whereas overproduction in adult life results in an asymmetrical, disfiguring overgrowth called acromegaly. In addition to the excessive physical development, the true giant offers also other evidences of hyperpituitarism such as excessive development of the sex organs, strong sex urge, hirsutism, decreased sugar tolerance, etc. As the hyperfunction of the pituitary does not necessarily cease at the time of complete ossification of the epiphyses, the hyperpituitary giant frequently develops acromegalic features. There are osseous proliferation of the terminal phalanges of the hands and feet, and also of the jaw and the periosteal surface of the bones in general with a predilection for the physiological protuberances. The transformation of the face is particularly characteristic. In both of these conditions the pituitary gland is found to be hypertrophied.

While the gigantic dimensions of the body are permanent, regardless of what may later happen to the pituitary, it is important to note that all other manifestations of hyperpituitarism exist only so long as the pituitary gland maintains its hyperactivity.

If exhaustion of the gland occurs or degenerative lesions set in, then the hyperactivity ceases and hypoactivity is substituted. In this way the excessive sexual desire may give way to impotency in the male and sterility or amenorrhea in the female. There are observed also a loss of strength and frequently pituitary obesity or terminal cachexia.

Timme has described what he calls a pluriglandular-compensatory syndrome (thymus-suprarenal-pituitary-compensatory syndrome) which bears his name. This condition, in its early stages, is said to be due to a hypoactivity of the pituitary gland with apparent secondary effects on the thymus and the adrenal. Recovery is dependent upon a compensatory activity with accompanying hyperplasia of the pituitary later in life. As in Froelich's syndrome, the primary deficiency is apparently not due to a lack of the growth hormone, for these indi-

viduals grow to good size and are generally well nourished. The condition usually starts before puberty with great muscular fatigability and with the genitalia showing insufficient development. The cardiovascular system is poorly developed, the blood pressure is low, and the blood sugar content is around the lower level of normal—signs considered as due to adrenal insufficiency. The thymus is unusually large.

During the second stage, which begins at puberty, the muscular fatigability is continued and sometimes increased. The genital development remains subnormal; the pelvic hair is scanty and has the characteristics of the opposite sex, axillary hair is absent, and there is no beard. The thymus frequently remains large. X-ray pictures show a small pituitary gland in a small sella turcica, often enclosed by the clinoid processes.

The third stage begins about the twentieth year. The patient has then reached a height of 6 feet or more, and is usually well developed muscularly; but in spite of apparent strength his weakness is extreme. Acromegalic signs, large hands, and large feet appear and headaches of a frontal and infratemporal localization are complained of. The blood pressure and the blood sugar level begin to rise, and X-ray pictures in cases that are progressing favorably show beginning signs of erosion of the sella and the clinoids. This represents the beginning stages of pituitary hypertrophy and compensation.

The fourth stage comes on from 3 to 10 years later and represents the "finished case." In the completely compensated individual the headaches disappear, the blood pressure and blood sugar levels are normal, and the patient is well, although showing features of acromegaly grafted onto the earlier manifestations of the thymic state. X-ray pictures show an enlarged pituitary which has been enabled to enlarge by eroding the confining sella and the clinoids. If the case does not compensate, the headache continues to increase in severity, the sella remains small and bridged, mental activity becomes sluggish, fatigability is increased, and there is a tendency to put on weight. Sometimes these individuals have attacks of "petit" or "gand mal", which require treatment with whole gland pituitary extract.

THE THYROTROPIC HORMONE

The discovery of a thyroid-stimulating substance from the anterior pituitary gland was made in 1929. As yet this substance has not been purified but it is known not to produce the other effects of pituitary transplants—growth phenomena, gonadotropic effects, and the like. Further, it has been shown that only in the presence of the thyroid gland does it exert its action, total ablation of the thyroid resulting in loss of its specific effect.

Underproduction of the thyrotropic hormone.—When the pituitary gland is removed, a condition of hypothyroidism invariably results; therefore hypothyroid states could well follow under-function of the pituitary gland. With considerable justification, then, might not the question be asked, to what extent are cretinism and myxedema primarily pituitary and only secondarily thyroid disorders? Unfortunately, the answer must wait until some method is devised by which the thyrotropic hormone present in the body can be measured quantitatively. Other features of this problem have been considered under dwarfism.

Overproduction of the thyrotropic hormone.—At the present time there is no clinical condition which can be recognized as due to an overproduction of this hormone. Experimental work to date seems to show that in cases of exophthalmic goiter the titre of the thyrotropic hormone in the body is low while in cases of myxedema it is high. This appears, on first thought, to be a contradiction following what has been said before but is explained as being due to a primary over- or under-activity of the thyroid with correspondingly less or greater call on the pituitary. At this time all that we can say is that much remains to be done before the activity of this hormone can be fully understood.

ADRENOTROPIC (INTERRENOTROPIC) HORMONE

The view that there is a definite relationship between the anterior pituitary gland and the adrenal cortex is amply supported by both clinical and experimental evidence. In hypopituitary states, such as that following hypophysectomy or seen clinically in dwarfism or pituitary cachexia (Simonds' disease), the adrenal glands are small and show a marked atrophy and hypoplasia of the cortex which can be corrected by pituitary transplants, or by treatment with pituitary extract, but which cannot be corrected by injections of the cortical hormone. On the other hand, in Addison's disease and in adrenalectomized dogs, histologic changes are found in the pituitary gland, among which is a reduction in the number of the basophilic cells. Treatment with the cortical hormone, cortin, is indicated in these conditions. On theoretical grounds it is conceivable that certain cases of Addison's disease may be due to a primary pituitary failure, and in this connection it is interesting to note in passing that, following treatment of cases of Addison's disease with the adrenotropic hormone, marked improvement has been reported. In these cases the improvement was attributed to an activation of the cortical tissue by the specific hormone. Of course where the adrenal cortex has been destroyed, as by tuberculosis, activation of this tissue by the pituitary hormone is impossible.

In hyperpituitary states, the reverse picture of the hypopituitary condition is seen. Here the adrenal glands are markedly hypertrophied; but, it is interesting to note, this hyperplasia is dependent upon the presence of the thyroid gland, although the thyrotropic hormone of the anterior pituitary does not seem to be essential to cause it. In cases of acromegaly, adrenal hyperplasia and cortical adenomata are often present; and one case of an acromegalic girl suddenly developing hirsutism, a condition interpreted as an adrenal effect, has been reported. Harvey Cushing has shown that many cases with cortical tumors—a hypercortical state—are associated with basophilic adenoma of the pituitary—a hyperpituitary state. Similar clinical pictures and symptoms are also given by arrhenoblastoma of the ovaries, an observation which has led to the assumption that there is a special pituitary-adrenal-gonadal relationship.

THE PANCREATROPIC HORMONE

In 1924 Houssay and Magenta, working with hypophysectomized dogs, showed that there was some substance in the pituitary gland which markedly affected carbohydrate metabolism. Since then this finding has been repeatedly confirmed although as yet the exact manner in which this hormone works has not been determined.

In 1933 Anselmino and Hoffman described the action of a principle from the anterior lobe of the pituitary gland which, when administered to animals, produced an increase in the size and number of the islands of Langerhans, a decrease in blood sugar and a marked reduction, almost to complete disappearance, of glycogen. For this substance they suggested the name "pankreatrope substanz" (pancreatropic substance).

But other workers, notably Evans and Houssay in 1932, showed that injection of anterior pituitary extracts into normal animals produced hyperglycemia and glycosuria with associated disturbances in fat metabolism dependent upon the disturbances in the carbohydrate metabolism. Assuming the extracts used in these experiments to be less purified than that used by Anselmino and Hoffman, the question naturally arises, is there also a "diabetogenic" principle produced by the pituitary? Collip believes there is and that the diabetogenic effect is the combination of the action of two independent substances, not yet isolated, one of which acts on the blood sugar and the other on the fats to produce ketosis.

If the pituitary does produce a pancreatic and diabetogenic hormone, then normal sugar metabolism is dependent upon the harmonious interaction of these two hormones. This in turn leads to the interesting new conception that diabetes may at times be due to a pituitary dysfunction and not solely dependent upon inadequate pancreatic insular function.

While there can be no doubt that the pituitary gland plays a role in the metabolism of carbohydrates, fats, and probably also of proteins, perhaps the latter through the growth hormone, its *modus operandi* will not be sufficiently clarified until the research work now being conducted is completed and conflicting statements as to the action of the pituitary on metabolism brought into harmony with the known physiology of the pancreas.

THE PARATHYROIDS, THYMUS, AND TESTES

Parathyroids.—Before leaving the pituitary a word should be said about the relationship of this gland to the parathyroids, the thymus and the testes as it is understood today. The parathyroid glands are concerned with calcium-phosphorus metabolism in a way of greatest importance to the body because it is necessary to the calcification of bone and teeth. In addition, it serves to control the varying normal degrees of irritability of nerve tissue as well as of voluntary and involuntary muscles.

Contrary to popular opinion at the present time, little is known concerning these glands so essential to life. In fact, it is interesting to note that recently claims have been made that they are not necessary. This is based on the reported survival of parathyroidectomized animals over one reproduction period when they were given vitamin D in large amounts. However, complete removal of these glands is practically impossible and confirmation of this opinion must await further work.

That there is clinical evidence for an interrelationship between the pituitary and the parathyroids has been reported by many investigators. The association of adenomas of the parathyroids with tumors of the pituitary gland is particularly suggestive of such a relationship. By administering a pituitary extract to the rat, Anselmo, Hoffman, and Herold in 1934 were able to produce parathyroid enlargement. In the same year Hertz and Kranes using a fraction obtained by acid extraction of the beef pituitary were able to produce mitotic cell division and vacuolization of the parathyroid cells in the rabbit. However, the reports on work with hypophysectomized animals remain conflicting, and until this phase of the problem is cleared up we cannot say definitely that there is a specific parathyrotropic hormone.

Thymus.—Uncertainty has characterized our knowledge of the thymus gland from ancient to modern times, and its function still remains a riddle. In fact, Hoskins states that "more and more, research of recent years has continued to cast doubt upon the thymus as a member of the endocrine congregation." The thymus and the parathyroids arise from the third and sometimes the fourth branchial

clefts, with the result that their development is intimately associated. Recent work further suggests that possibly they may share some functions together. Unfortunately, at the present time, there being no general agreement as to what the normal development of the thymus is, abnormal development can not be recognized. However, it is generally accepted as true that the thymus is largest, both relatively and absolutely, during the period of greatest growth—childhood—and begins to involute at puberty, thereafter diminishing in size.

What knowledge we have of the function of this gland has been acquired from two sources—(1) laboratory investigations of the effect of its removal at various ages and of the administration of thymus extract or the feeding of thymus substance and (2) clinical observations on patients correlated with autopsy study. Laboratory work, especially on the dog, has led to the conclusion that the thymus is not essential to life and that extirpation does not influence growth and development. Working with normal rats, however, Rowntree found that injections of an extract from the thymus led to a striking precocity after the third generation on succeeding generations, the young developing physically, sexually, and psychically at an unbelievable rate. Yet, although the growth was rapid, he was never able to produce a giant. X-ray pictures in these cases do show, however, increased length of the diaphyses of the long bones for the age of the animal as well as the early visibility of the centers of ossification of the epiphyses. This experiment indicates that an excess of this principle from this gland causes a rapid metamorphosis, but not true growth, since no giant rats were ever produced.

The well-known fact that the thymus diminishes in size after puberty has led to the hypothesis that this revolution is normally due to the activity of the gonads. Certain bodily states also cause a diminution in its size such as starvation, inanition, marasmus, and wasting diseases generally with the exception of Addison's disease and exophthalmic goiter (where it is enlarged).

Enlargement of the thymus is frequently diagnosed and may be associated, according to McCrea, with thymic stridor, thymic asthma, and status thymicolymphaticus (Timme's Syndrome). In these conditions, especially the latter, the thymus as well as most of the lymphoid tissue of the body shows enlargement.

The sudden death that is supposed to be due to hypertrophy of the thymus has never been proved to be due to an excess of thymus secretion. Further, it is hard to see how a soft, easily compressible glandular mass could compress the cartilaginous tracheal rings and produce suffocation. Thus, considerable doubt exists as to the possibility of a large thymus ever being the cause of sudden death.

From the foregoing it is apparent that there is still a state of ignorance rather than enlightenment relative to the thymus gland.

Testes.—As was said earlier, the work on the testicular hormones is considerably less advanced than that on the oestrogenic hormones. But it is known now that the testicle exercises two biologically important functions in the body, the primary of which is the maturation of germ cells and the secondary, the secretion of one of more substances known as the testis hormone ("androtin", "androstrone"). Recent work indicates that the testicle secretes also an inhibitory hormone, "inhibin", which prevents, through control of the gonadotropic principle of the pituitary, overproduction of androtin and resulting prostatic hypertrophy.

Androtin.—This hormone is fat-soluble and exerts its influence on the accessory organs of reproduction and secondary sexual characteristics of the male.

How early in life the testis begins to secrete its hormones is not known. To date, they have never been demonstrated in the urine of boys under 10 years of age. That the testes are capable of secreting hormones much earlier than they do normally is proved by the changes in the accessory reproductive organs and development of the secretory state following injections of gonadotropic substances. Precocious puberty in boys, although pathological, also demonstrates that the testicles can function earlier than they do usually. Animal experimentation has shown that, in constant breeders, once the hormone secretion is started, it is continuous thereafter, indicating that storage within the body does not exist and hence that secretion must be maintained for the existence of a functional group of secondary reproductive organs. This maintained activity is due to the influence of the anterior lobe of the pituitary gland, the testes not being self-regulatory. If the pituitary is removed, cessation of germ-cell production and hormone secretion follows. Restoration of testicular function can be accomplished by treatment with fresh pituitary material. In the strictly seasonal breeding types, indications are that the pituitary does not secrete continuously, and in some manner other agencies, especially environmental, play an important part in its activity.

Since the testicles are capable of secreting hormones in large amounts before puberty, but do not, and in adult life do not secrete the full amount of which they are capable, a reciprocal interaction with the pituitary gland has been suggested. It is well established that the pituitary secretions stimulate the gonads to activity and that their presence is essential for maintenance of function. Also, an excess of the gonad hormone so influences the pituitary that less of the gonadal stimulating factor is present. Further, it has been found that the pituitary of castrates is a more potent stimulator of sex gland activity than that from normal animals. All of this is strongly

suggestive of the controlling reciprocal activity between the gonads and the pituitary.

At the present time nothing can be definitely stated as to the therapeutic value of the hormone, androten. Nothing is known regarding the usual needs of a normal man or the amount that the castrate requires as a daily replacement dose. From the existing evidence the testis hormone cannot be considered a stimulator to hypofunctioning testes; in fact, large doses of the hormone are actually injurious to testicular tissue and, in addition, depress the stimulating factor from the anterior pituitary. Since the action of this hormone has to do primarily with the development of secondary sex characteristics and reproductive organs, perhaps its greatest sphere of usefulness will be in the treatment of prepubertal castrates to insure development of the indices of maturity such as change of voice, characteristic hair growth and distribution, and development and growth of the genitalia.

Inhibin.—During the past few years there has appeared in the literature reports of the glandular treatment of prostatic hypertrophy with the hormone "inhibin", a water-soluble factor derived from the testicle. To date, this hormone has not been definitely isolated but has been postulated by the experimental work done by the group at the Cleveland clinic, particularly that of Lower and McCullagh. The soundness of this theory and the basis for optimism as to its future rest on the following facts: (1) Atrophy of the prostate and seminal vesicles follows removal of the pituitary in experimental animals (rats). Feeding with androten will restore these organs to normal, whereas inhibin has no effect. (2) Feeding normal rats inhibin results in prostatic atrophy. (3) In female rats, inhibin diminishes the frequency of the oestral cycle, and in male guinea pigs reduces the ejaculatory reflex and the amount of the ejaculate. (4) If two rats, one of which is castrated, are placed in parabiosis by connecting peritoneal cavities, the prostate and vesicles of the castrated rat atrophy. The theoretical explanation of this is that the gonadotropic hormone in the anterior pituitary of the castrated animal increases in amount because the inhibin which limits its production is not available. This hormone then passes over to the uncastrated animal and stimulates the testicle to form androten which in turn stimulates growth of the prostate and seminal vesicles. Androten, being fat-soluble, cannot pass over to the castrated animal and cause prostatic and vesicle hypertrophy. On the other hand if either of the animals is fed the water-soluble hormone inhibin, it passes from one to the other and the prostate and the vesicles of the castrated animal atrophy.

This entire process may be summarized as follows: The testicle produces two hormones which affect the secondary sex organs and

sexual characteristics—(1) androgin, which is stimulating, and (2) inhibin, which, through its action on the anterior lobe of the pituitary, prevents overproduction of the gonadotropic hormone and thus overproduction of androgin. If inhibin is absent, or present in insufficient quantity, there follows hyperactivity of the anterior lobe of the pituitary with overproduction of the gonadotropic hormone which stimulates the testicle to produce an oversupply of androgin which in turn produces prostatic hypertrophy.

Undoubtedly the discovery of inhibin opens up a very pleasant possibility for the patient of the future who develops prostatic hypertrophy. At this time this method of treatment is neither standardized nor definitely proved. The future of glandular treatment for prostatic enlargement rests upon ultimate isolation and purification of this hormone and determination of its effect on the prostate which has already undergone hyperplasia. Also it must be determined whether there are any subsidiary effects which would contraindicate its extensive use clinically. Like many new things, it may prove a great disappointment, but it is well worth keeping in mind until definitely proved or disproved.

THE POSTERIOR PITUITARY

The posterior lobe of the pituitary is also called the pars nervosa, as it is composed of neuroglial cells, pituicytes and nerve fibers. The neuroglial cells resemble those found elsewhere in the central nervous system. In the posterior lobe the neuroglial cells become differentiated to form pituicytes which are highly branched cells containing granules in their cytoplasm. It is highly probable that the pituicytes are the secreting elements.

The posterior lobe secretion is elaborated by the intrinsic elements of the lobe itself and enter directly into the general circulation by way of the blood channels. Refined assay methods have failed to reveal posterior lobe hormones in the cerebrospinal fluid.

The active hormones present in the posterior lobe extracts have not yet been definitely isolated, although two fractions, pitressin and pitocin, have been separated in a fairly high purified state.

Posterior lobe extracts at the present time are assayed against an international pituitary powder. The unit is the activity contained in one-half milligram (0.0005 g) of this powder (U. S. P. X).

The inability to completely separate pitressin and pitocin from posterior pituitary extracts has necessitated assigning the multiple activity of solution of pituitary, U. S. P. X, to these two fractions.

Pitressin (surgical pituitrin; vasopressin) produces cardio, vascular, respiratory, renal, intestinal, and certain metabolic effects. Pitocin (obstetrical pituitrin; oxytocin) produces contractility of

uterine muscle. Since neither of these substances have been prepared entirely free of the other, there is of necessity some overlapping of the physiological effects. Both of these substances and solution of pituitary, U. S. P., also cause hyperglycemia and act as an antagonist of insulin.

Pitressin.—Pitressin when given intramuscularly produces first a brief fall in the pulse rate, cardiac output and oxygen consumption which is soon followed by a prolonged rise. Small doses may cause a sharp rise in blood pressure due to peripheral vasoconstriction. Large doses produce at first a fall to be followed by prolonged rise in blood pressure. This primary fall is said to be due to coronary constriction. Pitressin produces a marked constriction of the small gut, but other effects, cardiac, renal, and vascular must be kept in mind when it is given. Most experiments tend to show that the depressor action is cardiac and that the tolerance factor is peripheral. Tolerance is easily acquired and repeated doses give a lessened response.

Pitocin.—The action of pitocin depends upon (1) the phase of the menstrual cycle; (2) the state of the uterus, whether gravid or non-gravid; (3) if gravid, the state of pregnancy, early or late; and (4) parturition or puerperium.

The physiology of the uterine response to pitocin becomes more intelligible when viewed in the light of the newer researches dealing with the effects of the uterus of the oestrogenic and corpus luteum hormones and their coordination with the hormones of the anterior as well as the posterior lobes of the pituitary. As stated before, the ovaries, placental, or anterior pituitary hormones affect the nature of the action of uterine muscle to pitocin in accordance with the influence of the hormone which is preponderant at the time of the injection of pitocin.

In the first 2 months of pregnancy the human uterus does not react to pitocin owing to the inhibitory effect of the luteal secretion of progesterin. Late in pregnancy reaction to pitocin returns owing to the influence of theelin (oestrin) in rendering the uterus reactive. During parturition the uterus is very sensitive to pitocin. However, during the puerperium, when the uterus is undergoing involution, pitocin evokes little or no response.

Recent experiments have not confirmed the statements made that such diseases as eclampsia, toxemia of pregnancy, and angina pectoris are due to the hypersecretion of the posterior lobe.

Solution of pituitary (U. S. P.), pitressin and pitocin exercise an antagonistic action on insulin. Therefore, hyperfunction of the posterior lobe produces hyperglycemia, glycosuria and high sugar tolerance.

Conclusion.—It seems strange that one cannot assign any definite physiologic role in the animal economy to the highly potent autopharmacological agents secreted by the posterior lobe. From the standpoint of physiology we may say that possibly pitressin regulates the exchange of metabolites between the blood and tissues and exercises a renal function. The only known function of pitocin (oxytocin) is to quicken and render more effective uterine contractions which result in the expulsion of the foetus and the sloughing of the endometrium to complete menstruation. The recent idea that pitressin and pitocin may be mutually antagonistic possibly accounts for some of the contradictory effects noted by different investigators.

From what has been said it can be seen that the problem of the physiology of the pituitary gland has become markedly more complex rather than simplified by the investigations reported during the past few years. That the validity of this statement cannot be questioned is attested by the fact that there are now an increased number of known hormones, the interrelationships of which have hardly been explored either functionally or clinically, and by the fact that there has been shown to be a different capacity of response in various species and even in the same species at different age levels.

THE THYROID GLAND

Although the interrelationship of the thyroid to the pituitary gland has been discussed, and while the major serious disabilities due to disturbed thyroid functions are known; as the interrelationship of this gland with the other organs of the body becomes better understood it is to be expected that lesser disabilities also may be proved to have a definite relationship to the thyroid. Recent work has shown that in addition to the pituitary interrelationship, the thyroid physiology is intimately associated with that of the sex glands, thymus, pancreas, liver, adrenal cortex, adrenal medulla, and the kidneys as well. Since the principal function of the thyroid gland is to increase oxidative processes in the body, it is easy to see how all body activities may be influenced by the state of thyroid function.

In 1874 Gull noted and described the clinical picture due to thyroid deficiency in adults, and 4 years later Ord gave the name myxedema to this condition. In 1882 complete removal of the thyroid gave the same picture, thus experimentally proving Gull's observations. In 1891 the curative effects of thyroid medication in hypothyroid states was reported, to be followed in 1895 by the announcement that the thyroid gland contained iodine and the therapeutic value of iodine on hypothyroid states, known for 75 years, was thus placed on a rational basis. In this same year, 1895, it was demonstrated that in Gull's disease (hypothyroidism) the basal metabolism rate was low

and that treatment with thyroid raised it to normal or above. In 1916 the hormone thyroxin was isolated but it was not until 1926 that its formula was determined. In 1927 thyroxin was synthesized for the first time.

The most characteristic physiological action of thyroxin is that, after a latent period of 12 hours or more, it increases the oxidation of the proteins, carbohydrates, and fat and increases the excretion of certain minerals, notably calcium and magnesium. At the present time the means by which thyroxin increases the oxidation processes is not known.

Other effects of thyroid activity have been discussed in the section on the growth hormone.

THE PARATHYROIDS

Normally there are four parathyroid glands, two on each side, which are situated just behind the lateral lobes of the thyroid, and at times they may even be embedded in the thyroid gland itself. These glands secrete a hormone known as parathormone (Collip) or paraidin (Hanson). One hundred units of parathormone is that amount which will increase the calcium content of a dog's blood 1.0 milligrams per 100 cubic centimeter.

The primary function of this hormone appears to be the regulation of the metabolism of calcium and phosphorus. Secondly it may control the irritability of nerve tissue as well as voluntary and involuntary muscle. The parathyroids also play an important role in the clotting of blood and the curdling of milk.

Hyperfunction of the parathyroids (hyperparathyroidism) produces a multiplicity of symptoms. The most common mode of onset is with pain in the muscles of the legs, arms, and back which may often be interpreted as rheumatic. This is followed by localized and then generalized bone tenderness, disturbance of gait, and intermittent claudication. The muscle weakness may be so extreme as to lead to the erroneous diagnosis of Addison's disease or myasthenia gravis. The bone changes are very characteristic and prominent. At first they are osteoclastic in type resulting in demineralization of all bones of the skeleton to be followed by osteoblastic activity producing fibrosis with multiple cysts. This is the typical *ostitis fibrosa cystica* (von Recklinghausen's disease). Anemia and leucopenia develop because the fibrosis and cystic degeneration crowd out the hematopoietic elements. The next prominent symptoms are those referable to the genito-urinary tract in which we have urinary calculi, polyuria and polydyspia. Calcium phosphate precipitates in the collecting tubules of the kidney producing renal calculi. Polyuria and polydyspia are compensatory mechanisms to rid the body

of excess calcium and is comparable to the same mechanism in diabetes mellitus whereby the body is freed of excess sugar. The laboratory findings, a high blood serum calcium (above 12 mg percent) and a low phosphorus (below 3 mg percent) when present is said to be practically diagnostic.

Hypofunction of the parathyroids (hypoparathyroidism) results in tetany. In tetany we have a hyperexcitability of the entire nervous system accompanied by carpo-pedal spasm and generalized convulsions. The most characteristic is the obstetrical hand. This condition is accompanied by a low level of blood serum calcium (below 7 mg. percent) and a rising phosphorus level (above 4 mg. percent). While the parathyroids are necessary for life, little is known of these glands or their action, but to be effective the parathyroid hormone must be given either intramuscularly or intravenously.

THE ADRENAL GLAND

That death follows destruction of the adrenal glands in humans, or their complete removal in most animals, has been known for some years. Further, it was found, subsequent to the isolation and synthesis of epinephrine, a secretion of the adrenal medulla, that regardless of the size of the dosage, this substance would not maintain life. However, a substance from the adrenal cortex has been found which is capable of maintaining life, and by experimental work has been found to be essential to it. This hormone from the cortex is called "cortin" or "interrenalin."

Adrenal cortex.—Much speculation exists as to the primary function of the adrenal cortex. Some suggest that it is a regulator of carbohydrate metabolism, others that it regulates the volume of the circulating blood and still others that it exerts a controlling influence on sodium metabolism, but actually in spite of all the recent work, both clinical and physiological, its function is yet unknown. However, these studies have shown that absence or insufficiency of the cortical hormone results in a marked disturbance of sodium metabolism with resulting decrease in body sodium, decline in the chloride or bicarbonate concentration, or both, and increased excretion of water. The progressive loss of salt and water leads to the depletion of the volume of circulating fluid and the fluid within the tissue spaces. This latter, by osmotic exchange of fluid, leads to a further decrease in the blood volume, with the development of a state of shock.

With the loss of salts and fluids from the body, the symptoms of dehydration occur. They are:

(1) Decrease in concentration of sodium in the blood, with a fall in blood chloride or bicarbonate, or both.

- (2) Increase in plasma protein concentration and in the oxygen capacity of the blood.
- (3) Decrease in plasma volume.
- (4) Decrease in rate of blood flow.
- (5) Increased chloride excretion.
- (6) Loss of weight.
- (7) Muscular weakness.
- (8) Vomiting.
- (9) Diminished blood pressure.
- (10) Diminished metabolism rate.
- (11) Increase in nonprotein nitrogen of blood and often of urea.
- (12) Anuria when shock and dehydration are extreme.

Naturally, as a result of such marked disturbance in physico-chemical equilibria, we find impairment of renal function, lowered carbohydrate metabolism, decreased oxygen consumption, circulatory collapse, gastro-intestinal disturbances, and neurological manifestations.

Adrenal medulla.—The hormone of the adrenal medulla, epinephrine, is one of the most widely used drugs in medicine; yet the function of the gland from which it is derived, although extensively studied both experimentally and clinically, is at present poorly understood. The close anatomical relationship of the adrenal medulla and cortex suggests that in higher animals the function of the essential secretion of the cortical portion may in some way be aided by the less vitally important products of the cells of the medulla.

It is strange that an important role in the body cannot be attributed to the epinephrine secretion. This hormone yields definite reactions, quantitative information on its rate of secretion under different conditions is available, and control of secretion through nervous mechanism has been well established. Yet, though it lends itself well to experimental study, no specific function for epinephrine has been proved, and its absence has been shown to be compatible with life.

The theory of an "emergency function" of the adrenals, based on the concept that epinephrine is not secreted under ordinary conditions but enters the blood stream under periods of special stress has not been borne out experimentally. In fact, quantitative studies indicate that epinephrine secretion is continuous and is not altered significantly by these conditions. Other theories advanced as to the role of epinephrine, namely, that it maintains the blood pressure within the average normal level, or that it is correlated with carbohydrate metabolism, have been completely submerged in the extensive literature on the emergency theory. But that these theories are no better than the others is proved by the fact that suppression of

epinephrine does not change the blood pressure and by lack of evidence that there is an antagonism between it and the internal secretion of the pancreas.

Unlike other glandular products, the therapeutic value of epinephrine does not depend on its capacity to make good a lack of physiologic function of the gland from which it is derived. Its value as a therapeutic agent depends primarily on its pharmacological action on the circulatory apparatus and tissues supplied with nerves from the sympathetic system. It is most effective when given intravenously; less so when given intramuscularly owing to retarded absorption. By mouth it is specifically ineffective, and so administered may result in distressing gastric irritation.

THE PANCREAS

In addition to being a gland of external secretion, the pancreas through the islands of Langerhans is also a gland of internal secretion and the source of insulin. Extensive study of the cells of the islands of Langerhans has developed the fact that the beta cells, those cells nearest the periphery, are the chief, if not the only, source of insulin. Around the islet cells there is an arrangement of capillary loops by which the insulin is picked up and carried into the systemic circulation.

What it is that determines the secretory activity of the islet cells and the resulting liberation of insulin into the circulation is unknown. One theory is that it is the sugar level of the blood passing through the pancreas; another is that it is through nerve control, possibly the vagus; another that it is through the intermediary of some other hormone (pancreatropic hormone of anterior pituitary gland). None of these conceptions, however, have had as yet general experimental confirmation.

Further, effects of other hormones antagonistic to that of insulin, with resulting blood sugar elevation, have been suggested and in some cases, to some degree, have been supported by experimental work. These are: Epinephrine, thyroxin, posterior pituitary extract, and the diabetogenic substance from the anterior lobe of the pituitary gland. However, their method of action is not understood and we must await further study before this phase of carbohydrate metabolism is elucidated.

Likewise the mechanism of insulin action and where it operates in the chain of chemical events concerned with the oxidization of carbohydrates remains obscure. In this country, at the present time, it is believed that insulin is secreted into the tributaries of the portal system, its first effect being upon the liver, with the result that much of the glucose in the portal vein is synthesized to glycogen and

deposited in the liver. Further, it seems well established that it does not act directly on blood glucose even in the presence of oxygen and does not take part in the oxidative changes associated with muscular contraction, for the diabetic animal is still able to form lactic acid. Hence, it is more probably concerned with the continued combustion of glycogen during rest. Since the oxidization of carbohydrates in the body is definitely dependent upon insulin, indirectly the metabolism of other food substances, proteins, fats, and minerals, are involved since a suspension of normal metabolism in respect to one factor has its effect on associated agencies.

THE PINEAL BODY

The pineal body is a rudimentary structure lying between the corpora quadrigemina and between the posterior ends of the optic thalami. Its function is not known but recent experimental work indicates that this organ may have an endocrine function. A variety of effects have been reported following the injection of pineal extracts. But the reports are so conflicting that one cannot even intelligently speculate as to the function of this gland. There is no active extract of the pineal body available commercially and much more needs to be known before crude extracts should be used therapeutically.

PADUTIN

In 1926 Frey and Krant isolated a substance from urine which lowered the blood pressure of animals when injected intravenously. This substance was subsequently named "kallikrein" and later "padutin." Further work showed that this substance when given intramuscularly would lower the blood pressure in hypertension and inhibit the pain of angina pectoris and intermittent claudication. A few years later a substance giving the same vasodilator action was found in the fluid of a pancreatic cyst, in an extract of normal pancreatic tissue free of insulin, and in an extract of skeletal muscle, the latter being given the name "myoston." This led to the conclusion that vaso-dilatation was attributable to a hormone, secreted by the pancreas, widely distributed in the body, and excreted in the urine.

It is assayed biologically so that one unit represents the amount which when given intramuscularly produces marked dilatation and reduction of blood pressure in the carotid artery of dogs. Since its effects are observed chiefly upon the smaller peripheral vessels, it is used primarily in those conditions which are characterized by localized vascular spasm.

(To be continued)

LYMPHEDEMA OF THE EXTREMITIES¹

By EDGAR V. ALLEN, M. D., F. A. C. P., Division of Medicine, the Mayo Clinic, and
IRWIN L. NORMAN, Lieutenant, Medical Corps, United States Navy

Lymphedema of the extremities has been considered in detail elsewhere.

Three hundred cases studied at the Mayo Clinic lend themselves to division into two main groups—inflammatory and noninflammatory; the terms infectious and noninfectious could be used as well. The division into the two groups indicates the original state; lymphedema, which is originally noninflammatory, may be complicated eventually by inflammatory changes. Most cases of lymphedema may be classified without difficulty according to the tabulation. The classification is purely clinical.

Lymphedema, which affects human beings, appears to have a multiple etiology. The mechanism of its production, which is, however, apparently the same in all cases, is predicated on clinical and experimental observations. Lymph stasis occurs primarily as a result of obstruction that is produced by inflammatory or noninflammatory processes, or by lymphangiectasis, which occurs in association with congenital lymphedema. When obstruction occurs, the intralymphatic pressure increases, and causes dilation of lymph vessels with subsequent insufficiency of the valves, forcing lymph to seek new channels which are supplied inadequately with valves. Since valves are very important in causing the lymph to move centrally, incompetence of the valves causes further stasis of lymph. The protein content of the lymph increases and fibroblasts proliferate rapidly since the lymph is an excellent culture medium for the growth of fibroblasts. This fibrosis contributes further to lymph stasis. As a result of the increased quantity of lymph in the tissues, attacks of acute inflammation may recur, producing thrombosis of lymph vessels, more stasis of lymph, and, hence, more fibrosis. The cycle, which is a vicious one, consists of stasis of lymph, fibrosis, inflammation with further stasis, and, hence, more fibrosis.

NONINFLAMMATORY LYMPHEDEMA

Primary lymphedema.—"Lymphedema precox" is an original term applied to a definite clinical syndrome manifested in 93 cases in the group studied. It affected female patients predominantly (87 percent of the cases), and in the majority of instances (65 percent) had its onset between the ages of 10 and 24 years, inclusively. The term "precox" is used to denote an early development; in many of the cases in this group the onset of symptoms occurred at puberty, and the incidence of onset in adolescence was impressive.

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The swelling occurs spontaneously and without known cause; at the onset the patient ordinarily notices a puffiness about the foot or ankle. The edema is worse during long periods of activity, during the menses, and in warm weather. Rest in bed and elevation of the extremity produce temporary disappearance of the edema that may affect one lower extremity exclusively (70 percent in this series) or both legs simultaneously; one extremity may swell months or years after the opposite member has become involved.

The edema ordinarily progresses up the leg slowly, and eventually the entire limb becomes edematous over a period of months or years. The spread of the edema may, however, be much more rapid; the entire limb may be involved within a few days or weeks. In many instances, swelling is limited to the foot and ankle or does not extend above the knee. Frequently, this particular state is doubtless merely a phase of a progressive condition, but in other instances it seems to represent the maximal degree of extension of the edema.

Gradually the swelling, whatever its limitations, becomes more marked; elevation and rest in bed cause its reduction but not its disappearance. The smooth skin becomes roughened, and the hitherto soft edema becomes resistant to pressure. In addition to enlargement of the limb due to edema, there is actual hypertrophy of tissue, and the limb becomes unsightly, ungainly, and uncomfortable. A dull, heavy sensation is present, but there is no actual pain.

The entire course of the swelling is ordinarily one of smooth progression; acute lymphangitis and cellulitis occur infrequently (in 13 percent of the cases studied). Ulceration of the skin does not occur. The entire history is ordinarily that of conversion of a normal limb into a swollen one; nothing else is noteworthy.

The cause of lymphedema precox is obscure. The predominant incidence among female patients, the onset in the majority of cases during adolescence, and the accentuation during menstruation tend to indicate that the reproductive organs play a part in the condition. Possibly the additional load thrown on the lymph vessels by rapidly developing reproductive structures induces a functional incompetence of the lymph vessels or allows entrance of infection into the lymph trunks and nodes in the pelvis. Even minor degrees of functional inadequacy, through obstruction in the pelvis, might lead to dilatation of the lymph vessels below, with incompetence of the valves, particularly among women, whose subcutaneous tissues offer little support. The resulting interference with the free passage of tissue fluid into the lymph vessels provides adequate encouragement for the growth of fibroblasts and further obstruction by connective tissue. Homans, Drinker, and Field reported a case in which the lymphedema apparently was of the precox type. At exploration, greatly enlarged lymph vessels were found in the pelvis; this was an indication of

obstruction proximally. It is possible that the entire explanation rests on a congenital underdevelopment of lymph vessels, or their inability to develop quickly enough to supply adequately tissues that are growing rapidly. Limitation of the disease to the lower extremities is striking, and it indicates that gravity is an important factor in the development.

Illustrative case.—A Jewess, 32 years old, was admitted to the clinic May 15, 1936, complaining of a swollen right extremity. This swelling, which had appeared 1 year previously in the region of the ankle, had gradually progressed until the entire extremity from the dorsum of the foot to the inguinal region had become involved. During the first few months the swelling had fluctuated in degree, but in the 6 months preceding admission it had remained relatively stationary, although elevation of the leg for any prolonged period had reduced the size somewhat. There was no associated pain and no history of any preceding trauma or infection.

On examination at the clinic, the right leg was found to be about half again as large as the left, pitting edema of the dorsum of the right foot, right leg, and right thigh being present. There was no evidence of disease of the kidneys, heart, or pelvic structures. Fissures were present between the toes, but trichophytes could not be demonstrated microscopically. A Kondoleon type of operation was advised but the patient refused. Adequate supportive bandaging was therefore recommended after elevation of the limb until there had been maximum reduction in the size of the limb.

Congenital lymphedema.—This may be either simple or familial. In both types, lymphedematous swelling, usually of one lower extremity, is present at birth. There may be actual hypertrophy of the limb which is the result of fibrous hypertrophy. In other instances, the skin is soft, and the edema is less resistant to pressure. The two forms do not vary, except that in the simple type blood relatives are not similarly affected. In the familial type, several persons in the same family have lymphedematous swellings of one or more extremities. The familial type, known as Milroy's disease, was first described by him as a clinical entity in 1892.

Secondary lymphedema.—This may be the result of malignant occlusion of lymph vessels by metastasis of malignant disease of the breast, uterine cervix, uterus, vulva, prostate gland, bladder, testes, skin, or bones to adjacent lymph nodes. Such a possibility serves to emphasize the necessity of close scrutiny for evidence of malignant disease in all cases of lymphedema, since swelling may be the first outward manifestation. Pressure outside the lymphatic trunks perhaps occasionally, but rarely, produces lymphedema. The one case of lymphedema apparently due to pressure in this series seemed to follow the use of a truss for inguinal hernia. Secondary noninflammatory lymphedema may occur in cases of Hodgkin's disease, or lymphosarcoma, or it may be associated with multiple hemorrhagic sarcoma, which has been described by Kaposi; or it may follow sur-

gical removal of lymph nodes and lymph vessels for malignant disease distally situated, or for tuberculosis or metastasis of malignant disease. The last named condition is the elephantiasis chirurgica of Halsted. Such a condition is not uncommonly seen following radical amputation of the breast and the removal of the axillary lymph nodes for carcinoma. The lymphedema may occur with or without intercurrent attacks of lymphangitis and cellulitis. The irregular interval at which lymphedema occurs after radical amputation of the breast is remarkable. Usually, the arm begins to swell on resumption of activity, but weeks, months, or even years, may pass before the extremity becomes edematous. In one instance, the arm was free from swelling for 9½ years; there was no evidence of the recurrence of malignancy to account for the edema; and cellulitis and lymphangitis had not occurred. In such instances, it is possible that fibrosis may be induced by repeated irradiation, thus producing lymphatic obstruction, or that occult lymphedema, which has been present for years, has resulted in overgrowth of connective tissue and obvious edema. Lymphedema may occur after treatment with radium and roentgen rays. Whether such a result is brought about by the fibrosis caused by irradiation or by metastasis of the malignant disease for which radiation is given cannot be determined with certainty.

INFLAMMATORY LYMPHEDEMA

General characteristics.—The advanced stage of inflammatory lymphedema has been called "elephantiasis nostras streptogenes." All examples of inflammatory lymphedema, exclusive of the chronic form, have one feature in common, single or recurrent attacks of acute cellulitis and lymphangitis. The contrast between lymphedema of inflammatory origin and of the precox type is striking; in the former, progression is by a series of attacks which are impressive in the suddenness of onset, and striking in the severity of systemic reaction; in the latter, the history is one of slowly progressive edema. The usual victim of an attack of cellulitis and lymphangitis of an advanced grade is suddenly seized with a severe chill unpreceded by other symptoms, or, following a short period of distress in the extremity or in its proximal lymph nodes, his teeth chatter, the bed shakes, and he becomes nauseated and vomits. His temperature is between 101° and 106° F.; in a short time a small, reddened area spreads until a considerable portion of the extremity is swollen, red, hot, and tender. The proximal lymph nodes are tender and swollen. The chills recur during a period of 30 minutes to an hour. The high fever persists for a period ranging from a few hours to 2 or 3 days, and is accompanied by marked malaise that may persist after the temperature returns to normal. The abnormal condition of the

extremity recedes slowly over a period of from 4 to 14 days, but, after all clinical signs of acute inflammation have disappeared, swelling is present in a greater degree than before the attack. The organism chiefly responsible for the attacks of acute inflammation is the streptococcus.

Single attacks leave minor degrees of lymphedema, but successive attacks, which tend to occur progressively more frequently produce increasing edema; each attack is a step toward the final stage, namely marked lymphedema. The chronic form of lymphangitis of the spontaneous type is exceedingly rare. In such instances, the leg is persistently warmer than its companion member, and a reddish discoloration of the skin exists. In many instances, lymphedema following injury or infection develops without the intervention of acute attacks of lymphangitis and cellulitis or of clinical manifestations of chronic lymphangitis. The infection in such instances is considered to be subclinical. It should be emphasized that lymphangitis, whatever its nature, produces occlusion of lymph vessels by thrombosis which produces lymph stasis which in turn provokes further fibrosis and more stasis of lymph.

Primary lymphedema.—This term signifies a condition resulting from single or recurring acute attacks or from chronic lymphangitis and cellulitis not secondary to any known local abnormality, such as venous or lymphatic stasis or extraneous infection. In many such instances the lymphangitis appears to occur in much the same spontaneous manner as tonsillitis or phlebitis. In other instances it may be due to infections introduced into the lymph vessels through minor portals of entry unnoticed by the patient. The acute attacks of lymphangitis and cellulitis have been described; each attack leaves a residue of increased edema. In the chronic form of lymphangitis the edema is slowly progressive.

Secondary lymphedema.—This term indicates a condition resulting from lymphangitis secondary to known causes. The lymphangitis may occur in single or recurrent attacks or in a chronic form. Chronic edema of venous origin may predispose to recurrent attacks of acute cellulitis and lymphangitis, and thus to progressive lymphedema, but such instances are uncommon, in light of the rather common occurrence of thrombophlebitis resulting in edema.

Trichophytosis about the toes may induce recurrent attacks of acute lymphangitis. The inflammation and the resultant edema are ordinarily limited to the foot and ankle. It is probable that an etiologic relationship exists in but a small percentage of instances in which trichophytosis and acute attacks of lymphangitis occur in the same patient. It is not clear whether the trichophytes themselves or secondary bacterial invaders are responsible, even when the trichophytic

infection seems to be definitely related to the acute inflammatory attacks. Instances which strongly suggest that the Trichophyton is directly or indirectly responsible for the acute attacks are those in which marked evidence of trichophytic infections, such as desquamation and the occurrence of vesicles, precede the appearance of cellulitis and lymphangitis. Pregnancy and systemic diseases, such as influenza, typhoid fever, pneumonia, malaria, and filariasis, may lead to recurrent attacks of cellulitis and lymphangitis and result in lymphedema. Except in cases of filariasis, it is possible that the original lesion is a thrombophlebitis that produces lymphatic as well as venous occlusion. Occasionally conversion into the lymphedematous state proceeds without the intervention of attacks of acute inflammation; in such instances it is assumed that a condition of chronic lymphangitis exists or that the lymph vessels become obstructed by overgrowth of connective tissue, which is, in turn, a reaction to stasis of tissue fluid. Tissue fluid acts as an excellent culture medium; fibroblasts grow and fibrosis results unless the blood plasma is promptly returned to tubes lined with endothelium.

Local inflammation or injury of tissue most commonly leads to the production of lymphedema through the intermediation of single or recurrent attacks of lymphangitis or chronic lymphangitis. In the cases studied, such diverse causes as contusions, lacerations, surgical incisions, vesicles, abscesses, furuncles, burns, fractures, penetrating wounds, bites by dogs, tularemic abscesses, pelvic inflammatory diseases, and appendicitis were directly responsible. The acute attacks may occur weeks or months after the original trauma, which may not be associated with any marked clinical evidence of infection. Some stasis of lymph, subclinical in degree or unnoted by the patient, seems to exist; then, for some unknown reason, marked bacterial activity occurs, and an acute attack of cellulitis and lymphangitis is clinically apparent. It seems strange that minor abrasions should allow entrance of infection into the tissues, but the slightest wound of the corium may tear lymph vessels open and permit material to enter them directly. In many instances, the lymphedema occurred following injury or infection without the intervention of acute attacks of inflammation, and seemed to be caused by chronic or subclinical inflammation and thrombosis of lymph vessels, or by minimal lymph stasis which provoked connective tissue overgrowth.

Illustrative case.—An infantry captain, 33 years of age, was admitted to the clinic June 1, 1936, complaining of a swollen right leg. In April 1934, a horse had fallen on him, causing fracture of the right wing of the sacrum and separation of the symphysis pubis. He was treated in a hospital for 6 weeks with traction and a splint. Shortly afterward, while walking with the aid of crutches, he noticed swelling of his right leg and ankle. In August 1934, following an operation for ingrown toenail, chills and fever occurred and there

was evidence of acute cellulitis and lymphangitis, which left a residual swelling of the right ankle and foot. In September 1935, following exposure in a rainstorm, a second similar attack occurred. Since that time he had had six additional episodes of acute lymphangitis and cellulitis, characterized by chills and fever, prostration, and redness and increased warmth of the right leg. Following each attack, the swelling of his right leg had increased.

On examination at the clinic, there was massive swelling, with some pitting edema, of the entire right leg, from the toes to the groin. The skin was thickened and brawny with a reddish, shiny coloration. There was no evidence of cardiac or renal disease. The tissue between the toes was macerated and microscopic examination revealed trichophytes. The Kondoleon type of operation was recommended but the patient remained undecided. He was instructed as to adequate bandaging.

In this case it appeared that fracture of the pelvis had produced some lymphatic obstruction and lymphedema. Subsequently, recurrent episodes of acute lymphangitis and cellulitis occurred which were probably, but not certainly, due to trichophytes. Each episode of inflammation increased lymphatic block and caused more fibrosis.

MEDICAL TREATMENT

Medical treatment, in order to be of value, must be carried out early. There is no medical treatment of value when the limb is greatly hypertrophied from the overgrowth of connective tissue. Treatment must be instituted when the edema first becomes evident. The longer uncontrolled lymphedema exists, the more fibrosis occurs, and the less efficient medical treatment becomes. This point needs to be emphasized, for most patients seen at the Mayo Clinic who have lymphedema have had it for a long time, and marked fibrosis, which cannot be influenced by medical treatment, has already occurred.

Control of edema.—The rationale of attempting to control edema is based on a conception of the condition within the tissues. Large lymphatic spaces exist, valves are absent or are functionless as a result of dilation of the lymph vessels, and lymph, which ordinarily moves proximally as a result of muscular activity and the action of valves, is static, or flows to dependent parts. A close parallelism exists with the condition present in varicose veins. The problem is one of causing the lymph to move toward the body by preventing stasis. We know of no way to accomplish this medically, other than by compressing the limb by adequate bandaging. An important first step is elevation of the extremity until as much as possible of the lymph has been removed from the extremity. Cloth bandages are of little or no value; the support which they give is of little value. Elastic stockings are unsatisfactory in many instances, for the same reason; they tend to stretch and lose their elasticity. Adhesive bandages are somewhat more efficient than the previously mentioned supports. The entire criteria for establishing the value of any type of support is control of edema; a support which does not prevent

swelling, when the patient is active, is valueless; one which prevents swelling is adequate. We prefer a pure rubber roller bandage, 3 inches wide and 15 feet long. Of the three weights available, the proper one prescribed for any specific patient depends on the difficulty in controlling the edema. Ordinarily, the bandage is applied over a lisle stocking, beginning by making two turns about the foot, two figure-of-eight turns about the ankle, and progressing up the extremity to the knee. The toes and part of the heel are left exposed. The bandage should be removed and applied in the same manner each time, as it becomes shaped to the extremity on repeated use. If it is applied too tightly, the toes become discolored, cold and numb. If it is applied too loosely, edema results. Patients soon become adept at bandaging their legs efficiently. The bandage should be removed at midday and reapplied over a dry stocking after the patient has rested for an hour. The same procedure is repeated at night if the patient is active. If he remains home, he may remove the bandage and elevate the leg, while sitting. Patients object to wearing the bandages because of the inconvenience in applying them repeatedly, the slight discomfort, and their unsightly appearance. This is particularly true of women, who object to the appearance of the bandaged limb. Frequently, a well-fitting elastic stocking may be used for "dress" occasions and the use of the heavier rubber bandage may be reserved for ordinary activity. It is well to point out to women that the lymphedematous leg has an abnormal appearance which the bandage increases but little, and to emphasize that uncontrolled edema almost invariably causes a gradual increase in the size of the limb. We have no information regarding how long the bandage should be worn; in some instances, it must be used indefinitely; in others, improvement in circulation of the lymph may occur. Once every month or so, the bandage can be left off for a day as a trial. If edema reappears, the support must be worn again.

Treatment and prevention of inflammation.—The attacks of acute lymphangitis ordinarily subside spontaneously, but recovery appears to be hastened by elevation of the limb and by the application of hot moist packs. When reactions are severe, streptococcus antitoxins, such as those which are used in the treatment of erysipelas or scarlet fever, or polyvalent serums may be used. Blood serum from patients who recently have recovered from an attack of acute lymphangitis and cellulitis may be of value. We have never observed patients to whom we thought it necessary to give antitoxins or convalescent serum for an episode of acute inflammation.

Almost the entire problem, as far as infection is concerned, is the prevention of attacks. Unfortunately, we have no proved way of

accomplishing this. We have felt that some commercial preparations, such as streptobacterin, when administered for a long period have been helpful but we can offer no direct evidence. More logical would be the manufacture of an autogenous vaccine from organisms which have been isolated from the tissues at the beginning of the attacks. Again, we have no definite evidence that organisms can be isolated regularly during attacks or that a vaccine would be effective in preventing them. We hope that studies with animals which have lymphedema will demonstrate the value of this method. The periodic injection of a therapeutic amount of streptococcus antiserum every few weeks may be of value. Care should be taken to avoid serum reactions. Portals of entry, such as are present between the toes in the presence of trichophytosis, should be removed. When attacks of acute inflammation recur, trichophytosis should always be suspected and vigorously treated, if present.

SURGICAL TREATMENT

The necessity of surgical treatment of lymphedema is a frank admission of failure of medical treatment in those instances in which the best medical treatment has been carried out. In many instances, however, surgical treatment is necessary because medical treatment has been carried out inefficiently or not at all. Selection of cases of lymphedema for surgical treatment depends on the etiology and severity of the lesion. There is no need to perform the operation in cases in which malignancy exists or in cases in which causative conditions of greater importance than lymphedema, such as Hodgkin's disease or pelvic tumors, are present. Unfortunately, we cannot promise the patient who has mild lymphedema a great deal of benefit. The leg can be restored to normal size and to nearly normal shape, but there is no assurance that such restoration will be in any way permanent unless an adequate type of supporting bandage is worn for an indefinite period. Therefore, the more severe the case, the more one can offer in the way of relief with surgical treatment. The history of attacks of cellulitis is not a contraindication to surgical treatment, but on the other hand, one can reasonably assure patients who have had recurrent attacks of cellulitis that the frequency of these attacks will be reduced. One should, of course, not operate during an attack of cellulitis.

The immediate preoperative care of the patient should consist of rest in bed for a few days, with the affected limb elevated continuously to reduce the edema. A sling, which supports the limb at an angle of at least 45°, should be used. Diuretics, such as salyrgan, and firm bandaging may hasten the disappearance of edema. In three to six days, as a rule, the amount of lymph in the limb will

be minimal which will make the surgical procedure much easier than it would have been before. The various surgical methods which have been used for the treatment of lymphedema have been reviewed by Ghormley and Overton. The procedure used at the clinic is that which was described originally by Kondoleon and modified by Sistrunk.

The actual operation should be carried out under spinal anesthesia, using a tourniquet, applied as high as possible on the affected limb and usually without the customary towel beneath it. Two incisions are made along one side of the thigh or arm, extending as high as the lymphedema, so that a long strip of skin may be excised in an elliptical manner. The amount of tissue that can be removed will depend on the width of the strip of skin between the two incisions. As much as possible should be removed in order to reduce the size of the extremity greatly. When the incisions have been made through the skin the margins of skin to be left are undermined for a distance on either side, approximately half of the circumference of the extremity. The skin, subcutaneous tissue, and as much as possible of fascia, except that at the intermuscular septa and at joint capsules, are removed in one piece. Care should be taken not to damage the main cutaneous nerves. After removal of the tissue, the wound should be closed with interrupted sutures. No attempt is made to secure hemostasis, only the larger branches of the veins being ligated. In closing the wound, one should not hesitate to apply as much tension as is necessary; considerable tension may be applied without fear of sloughing. Indeed, it is better to have some tension than to have an excess of skin remaining redundant. A pressure bandage is applied and the tourniquet released slowly, taking several minutes to allow the circulation actually to return to normal. We believe this step to be of considerable importance as it is possible that the sudden flooding of the circulation with material from the large wound may have had something to do with the high incidence of surgical shock. The limbs are not elevated after the operation, so that materials from the wound get into the general circulation somewhat more slowly than if the limbs were elevated. Apparently, as a result of the methods mentioned, the incidence of postoperative shock in these cases has been reduced to almost zero.

After 10 days the dressing is changed, and if healing has advanced sufficiently, the patient is allowed to be up. Adequate bandaging, such as that described with the medical treatment, is necessary for an indefinite period. Crutches or cane are unnecessary when the patient resumes walking.

It is customary to wait from 3 to 6 months between operations. That is to say, we treat one side of an extremity and allow healing to

become complete before operating on the other side. Occasionally patients get enough improvement from the operation on one side to justify omitting the second stage, but, as a rule, a much better result will be obtained if both sides are subjected to operative treatment.

Ghormley and Overton recently have reviewed the results in 64 cases of lymphedema, in which the condition was treated surgically in the past 10 years. In 41 of these cases there was improvement of varying degrees; no improvement was noted in 8 cases; in 6 cases the patient had died; and in 9 cases the patients had not been traced.

Recurrent infection such as cellulitis and lymphangitis, which had been present in 25 instances preoperatively, was worse after operation than it had been before, in 6 cases; was improved in 9 cases; and had disappeared in 11 instances, as a result of the operation.

We are not wholly satisfied with the operation described. There is considerable doubt that the benefit, which follows, results from that effect which Kondoleon originally intended; namely, anastomosis of the superficial and the deep lymphatics, if, indeed, this actually occurs. Since the obstruction in many instances appears to be in the lymphatic vessels within the pelvis, little or no benefit would follow the shunting of lymph flow into the deep vessels in the leg, as these are continuous with the obstructed lymph vessels. The operation appears to us to be predominantly a plastic procedure, removing large valveless lymph spaces and hypertrophied connective tissue. As such, it is not a physiologic procedure but simply a plastic one, which corrects deformity. Since lymphedema has been produced experimentally, it is to be hoped that better methods of surgical treatment will be discovered. Perhaps the most satisfactory procedure will be found to be a combination of the plastic operation of Kondoleon, and one designed to carry the lymph around the area of obstruction, such as anastomosis of the lymphatic vessels of the extremity with those of the trunk. Such a procedure as the latter has been described by Gillies and Fraser.

TABLE 1.—*Classification of 300 cases of lymphedema*

A. Noninflammatory:

I. Primary:

	Cases
Precox	93
Congenital:	
1. Simple	12
2. Familial (Milroy's disease)	0

II. Secondary:

Malignant occlusion	32
Surgical removal of lymph nodes	61
Pressure	1
Roentgen and radium therapy	3

TABLE 1.—*Classification of 300 cases of lymphedema*

B. Inflammatory:	Cases
I. Primary (single or recurrent acute and chronic)-----	41
II. Secondary (single or recurrent acute and chronic):	
Venous stasis-----	13
Trichophytosis-----	5
Systemic diseases-----	5
Local tissue injury or inflammation-----	33
Filariasis-----	1

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AN ESTIMATE OF ARSENOXIDE (MAPHARSEN) IN THE TREATMENT OF
EARLY SYPHILIS¹

By R. P. PARSONS, Commander, Medical Corps, United States Navy

Since the introduction of arsphenamine in 1909 there has been a constant and feverish search for arsenicals that might be improvements over arsphenamine, but with practically no success.

Of the trivalent arsenicals, the test of time has shown them all (with the exception of neoarsphenamine) to be either definitely inferior to arsphenamine in therapeutic potency, or to have such serious disadvantages of other sorts that they have been one by one virtually discarded. Even neoarsphenamine has been found after long and critical study to be inferior to arsphenamine but has held

¹ From the syphilis department, U. S. Naval Hospital, San Diego, Calif.

its popularity because of the greater simplicity in its preparation for injection and greater speed in giving it in clinics where large numbers of patients must be treated in a limited time.

The real important source of worry with all these trivalent arsenicals has been the frequency of reactions, often serious and sometimes fatal. The records of the Navy experience in this respect are probably more accurate than any others and are quoted here:²

Reactions per number of injections

	Mild	Serious	Fatal
Arsphenamine ¹	1-1, 374	1-2, 067	1-37, 101
Nearsphenamine.....	1-1, 996	1-4, 008	1-26, 162

¹ These figures as to relative frequency of reactions as between nearsphenamine and arsphenamine are somewhat misleading since they appear to represent arsphenamine in an unfavorable light. Most of the 37,000 injections of arsphenamine represented here were given in the early part of the 11-year period (when less was known of safety precautions than at present). Actually, arsphenamine has been adopted as the much safer drug for routine use for patients in the male clinic at the San Diego Naval Hospital, where during the past 3 years 8,764 injections have been given with no serious reactions and a negligible number of mild reactions. In the female clinic, however, where nearsphenamine is used (by the same medical officers) the reaction rate is approximately as represented in the above tables except that no fatalities have occurred.

So the search has been largely for arsenicals of greater safety, even perhaps, if need be, at the sacrifice of a certain amount of anti-syphilitic efficiency.

The latest drug to have gained wide use through its promise of relative innocence in reaction production is metaaminoparahydroxy-phenylarsine oxide, commonly known as "arsenoxide" and sold under the trade name of "mapharsen", taken from the first letters of the components in its formula.

It is noteworthy that this drug should have emanated from the University of Wisconsin, from which came the pentavalent arsenical, tryparsamide, now proven of enormous value in neurosyphilis, particularly the forms that fit into the general syndrome of paresis.

The process of reasoning which led the investigators to look hopefully toward their studies that were to determine the therapeutic index of arsenoxide may be summarized somewhat as follows: The action of the arsphenamines, both as to toxicity and as to spirocheticidal powers, depends on their conversion by oxidation in the body to the trivalent oxides. Only about 15 percent of the metallic arsenic in an arsphenamine is so converted, the balance remaining in an inactive and therapeutically ineffective form. It is possible then that if only the therapeutically effective fraction of the products of the breaking down process of an arsphenamine could be used, and used in pure form and in amounts that would be safe and yet powerfully spirocheticidal.

² Taken from Annual Report of Surgeon General for 1935 and based on 37,101 injections of arsphenamine and 994,176 of nearsphenamine in the 11-year period 1925-35 inclusive.

cidal, we might have a drug that would combine superior antisyphilitic value with lowered incidence and severity of reactions.

It is of considerable historical interest here to note that in the early work of Ehrlich and Hata arsenoxide was quickly discarded as being too toxic, although it is understood that this belief was formed because one rat was killed by a dose much smaller than the minimal lethal dose of arsphenamine. It is also strange that such workers as Hunt (1) in 1921 and Voegtlin (2) in 1925 had given consideration to arsenoxide but feared that it was too highly toxic and believed that the margin of safety in their determinations of the chemotherapeutic index with animals was lower than that of arsphenamine.

Tatum and Cooper (3), however, in 1932 concluded from their animal experiments that in pure form arsenoxide possessed "a chemotherapeutic index equal to or greater than most other effective agents" and that in rabbit syphilis the therapeutic index was higher than that for any other antisyphilitic agent known to them. Their work led then to an enormous amount of investigation by themselves and others, using trypanosome infections in the rat and syphilis in the rabbit and special toxicity observations with other animals.

The work of Gruhitz (4) is about the latest published at this writing and appears to be well accepted and certainly quite consistent with reported clinical experiences in human syphilis during the last 2 years. Using trypanosome infections in the rat he found the chemotherapeutic indices as follows:

(The figures in the fractions express mg per kilo).

$$\text{Arsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal effective dose}} = \frac{140}{10} = 14$$

$$\text{Neoarsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal effective dose}} = \frac{200}{22} = 9$$

$$\text{Arsenoxide} \frac{\text{maximal tolerated dose}}{\text{minimal effective dose}} = \frac{18}{1} = 18$$

Using rabbit syphilis he found:

$$\text{Arsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal curative dose}} = \frac{140}{12} = 11.6$$

$$\text{Neoarsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal curative dose}} = \frac{200}{24} = 8.3$$

$$\text{Arsenoxide} \frac{\text{maximal tolerated dose}}{\text{minimal curative dose}} = \frac{18}{2} = 9$$

The only recent published report on animal work which suggests a seriously small margin of safety for arsenoxide is that by Raiziss and Severac (5). Using methods similar to those of Gruhzt they report for rat trypanosomiasis:

$$\text{Neoarsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal trypanocidal dose}} = \frac{400}{20} = 20$$

$$\text{Arsenoxide} \frac{\text{maximal tolerated dose}}{\text{minimal trypanocidal dose}} = \frac{18}{2} = 7.2$$

and in rabbit syphilis:

$$\text{Neoarsphenamine} \frac{\text{maximal tolerated dose}}{\text{minimal curative dose}} = \frac{200}{40} = 5.0$$

$$\text{Arsenoxide} \frac{\text{maximal tolerated dose}}{\text{minimal curative dose}} = \frac{11}{12} = 0.9$$

The marked discrepancies between the Gruhzt and the Raiziss-Severac figures are subject to various interpretations. On the basis of experience with human syphilis (as will be shown later) the conviction becomes very striking that the Gruhzt figures are much closer to the truth. In early human syphilis we know that lesions heal as quickly and serology reverses as quickly with arsenoxide as with neoarsphenamine if the arsenoxide is used in doses of one-tenth the size of the neoarsphenamine doses.

Also, we know that man tolerates arsenoxide in one-tenth the size of the customary neoarsphenamine dose better than he tolerates the customary (0.4 to 0.6 g) neoarsphenamine dose. The Gruhzt figures for rabbit syphilis show the curative arsenoxide dose to be one-twelfth that of the neoarsphenamine dose and the tolerated arsenoxide dose to be one-eleventh that of the neoarsphenamine dose. The Raiziss figures for rabbit syphilis show the curative arsenoxide dose to be one-third that of the neoarsphenamine dose and the tolerated arsenoxide dose to be one-eighteenth that of the neoarsphenamine dose.

By using quantitative Kahns and working with rabbit syphilis, Gruhzt has shown that the same results in Kahn reversal may be obtained with 1 to 3 mg arsenoxide per kilo as with 40 mg neoarsphenamine per kilo, and that 10 mg neoarsphenamine per kilo produces less Kahn reduction than 1 mg arsenoxide per kilo.

The most comprehensive report yet seen on the clinical use of arsenoxide is that by Foerster, McIntosh, Wieder, Foerster, and Cooper (6). These investigators used 2117 injections on 80 syphilitics over a period of 18 months. As they were forced to conclusions which they express with more than moderate enthusiasm over their results

and with considerable confidence as to the security of the place of arsenoxide in the future of the treatment of syphilis, we can scarcely be blamed for sharing some of their enthusiasm and confidence when we are able to report figures which appear to be even more favorable than theirs both as to therapeutic value and as to human tolerance.

If our scores appear to be better than theirs we believe this is first, because we have been able to maintain a closer continuity of treatment, having a military control over our patients (which they lacked), second, because they used no supplementary treatment in the form of heavy metals, and third, because we never exceeded 60 mg at a dose nor gave more than 1,800 mg in the course of a year.

Although they used 80 patients, only 54 of these were early cases and it is only in early cases of syphilis that a drug can be evaluated. Only in the early cases can one watch the effect on dark fields, the rapidity of healing of lesions and reversal of serology. In the older cases there is often irreparable pathology or serological positivity which many years of treatment could not modify, thus making impossible any study of comparative values of different antisyphilitic agents.

In brief summary, the results in the early cases of the Foerster group were as follows:

(a) Dark fields became negative in 14 to 16 primary lesions within 8 to 24 hours after an initial dose of from 60 to 120 mg. In 2 of the 16 lesions the dark field became negative in 26 and 48 hours after an initial dose of 40 mg.

(b) Surface lesions healed in 10 to 24 days (average 15.2 days) after an average of 4.5 injections.

(c) Mucocutaneous relapse was noted seven times in 5 cases, all from a group of 40 in which treatment was started in the secondary period. In the seven instances of relapse the patient had been without treatment for periods of 1, 2, 3, 4, 5, 6, and 7 months, respectively.

(d) In 32 of the 40 secondary cases the Wasserman was reversed to negative in an average of 74 days, after an average of 920 mg in average doses of 58 mg (average 15.8 injections). Among the eight cases in which serologic reversal was not accomplished, three showed positive spinal fluid changes on admission, and the other five received very irregular or insufficient treatment. In 12 of the 32 "negative" cases, the negativity held for 3 to 15 months of observation and treatment and in 6 of the 12 the negativity held for 5 to 8 months of observation after the treatment had been discontinued.

(e) Their results as to spinal fluid findings are so involved (because done at such varying periods and under such varying conditions as to cases) that no general conclusions on this point may be drawn. In 15 of 32 cases in which the spinal fluid was negative on admission the examination was repeated at periods varying from 4 to 18 months later. Eleven of the 15 were negative on the second examination; 4 were positive at periods of 4, 7, 9, and 13 months after the original examination.

(f) Observations on toxic reactions were based on 2,117 injections given to 80 patients, with average totals of 1,490 mg in average doses of 56.28 mg. There were 131 reactions, including 100 mild reactions of nausea, diarrhea, headache, weakness, or vertigo, and 31 reactions of the more severe type—

vomiting, abdominal pain, headache, lacrimation, salivation, pruritis, and erythema. Many of the doses were much larger than the now customary maximum dose of 60 mg. One man received 2,965 mg in 46 injections during 50 weeks; several patients received 80 mg twice a week; two patients with primary lesions received 120 mg for their first injection. No nitritoid reactions were seen and the only instance of exfoliative dermatitis was a recurrent attack in a patient whose original attack had been produced by other arsenicals.

Jaundice developed in 4 of the 80 patients. All four had received rather large amounts: 2,460 mg in 8 months, 2,370 mg in 6 months, 1,500 mg in 3 months, and 625 mg in 9 weeks, respectively. They all ran mild courses, one was probably a recurrent attack of cholecystitis, two resumed treatment after the disappearance of jaundice without its reappearance.

In planning our observations on a series of cases we adopted a program based on three points:

1. This is a comparative study in which results with arsenoxide are to be compared with the already well known obtainable results with the arsphenamines. The only variable is the arsenical; all other conditions are to be kept constant. Thus, the comparable dose as to tolerance (40 to 60 mg) is to be used in courses of 10 weekly injections with alternating bismuth courses of 10 weekly injections exactly as in the standard program we have used in our arsphenamine treatment.

2. The cases must be early, presenting surface lesions, in order that the rate of healing may be observed, and with the same possibilities as to serological reversal or seronegative maintenance that we would expect from the arsphenamines in a group of early cases.

3. The group need not be especially large but each member must be in a service status which will permit continuous treatment and close and frequent observation over a period of 1 to 2 years. A relatively small number closely followed will make a much more valuable study than a large number whose observation and treatment is only casual. The number must, however, be large enough so that on the laws of average and percentage possibilities there would be one or two or a few cases each of the more common happenings (central nervous system involvement, Kahn fastness, serological relapse, cutaneous relapse, toxic reactions, etc.) that we ordinarily look for in a group of syphilitics in their first year of infection while on adequate arsphenamine and bismuth treatment.

In order to satisfy the condition of point 2 we selected only cases in which no previous arsenical treatment had been received and in which the infection had not advanced beyond the secondary stage. To meet the requirements of point 3 we selected such cases as corpsmen in a duty status at the hospital, patients in a not-misconduct status (extra genital primary lesions, infections from marital sources) so that they could be held on the sick list and under observation over long periods without pay checkage, and patients who

for one reason or another gave us assurance that they would remain in the vicinity of San Diego and be available for treatment and examination as often and long as we might desire. Twenty cases was originally thought a sufficient number but six others were later added to the list to make up for any shortage that might occur if any of the original series escaped from observation before a year's treatment had been completed.

No detailed case reports are included here as these make tedious reading and are of such length as to fog the essential issues. The following is a tabulated form of the results in the 26 cases. A discussion of pertinent matters in some of the more special cases is given later.

Summarized discussion of results.—Twenty-five cases of early syphilis have been under observation and treatment with arsenoxide from 10 to 23 months, average 16 months.

All were healthy young men, ages 18 to 46, average 26 years.

None had received prior antisyphilitic treatment of any kind.

The age of the infections (appearance of primary lesion to beginning of treatment) ranged from 1 to 78 days, average 17 days. Seven cases (nos. 2, 3, 14, 16, 19, 20, and 22) had advanced to the secondary stage when treatment was started.

Twenty had positive dark fields, and of these 15 had positive Kahns before treatment was started. The dark fields became negative in 1 to 5 days after the first injection, average 1.5 days. Three with primary lesions had negative dark fields but were diagnosed by other means. Three had healed chancres on admission and were diagnosed by other means.

Chancres healed in 3 to 31 days, average 13.3 days, after treatment started (1 to 5 injections, average 2.3 injections).

Kahns before treatment started were as follows:

4 plus: 12 cases (including the 7 secondary cases, 3 healed chancres, and 2 chancres with negative dark fields).

3 plus: 5 cases (including 1 with negative dark field).

2 plus: 3 cases.

1 plus: 1 case.

Negative, 5 cases (all these remained negative and have been under observation 20, 19, 19, 18, and 13 months, respectively).

Among the 21 positive Kahn cases, 20 (exception case 17) became negative after 4 to 20 injections, average 8.9 injections. The Kahn in case 17 remained 4 plus until 20 injections each of mapharsen and bismuth had been given, then remained 2 plus until 30 injections of mapharsen had been given. It has since remained negative. The seven secondary cases became Kahn negative after 12, 12, 20, 17, 10, 11, and 10 injections, respectively, average 13.1 injections.

Case, age, and dates of treatment	Age of infection when treatment started (days) approximate	Dark field	Dark field negative in number of days	Chancres healed in number of days	Kahn before treatment	Kahn negative after number of injections	Injections mapharsen to date	Injections bismuth to date	Remarks
1. P. B. H., 20, Jan. 19, 1935, to Mar. 17, 1936.	10	Positive	1	7	3 plus	10	130	30	Spinal fluid negative all phases at end of 14 months' treatment. No clinical or serological relapse.
2. M. H. V., 28, Feb. 8, 1935, to Jan. 28, 1936.	25 or more.	Negative		24	4 plus	12	130	30	Treatment started in secondary period. Spinal negative all phases at end of one year's treatment. No clinical or serological relapse.
3. E. W. J., 20, Feb. 19, 1935, to Dec. 1, 1936.	38	Positive	1	13	do	12	140	40	Treatment started in secondary period. Spinal negative all phases after 14 months' treatment. No clinical but serological relapse in 18th month. Negative after 20th month.
4. H. W. F., 24, Feb. 24, 1935, to Mar. 21, 1936.	15	do	2	9	3 plus	3	130	30	Spinal negative all phases after 13 months' treatment. No clinical or serological relapse.
5. S. R. R., 18, Mar. 7, 1935, to Mar. 26, 1936.	29	do	1	11	4 plus	10	130	30	Spinal negative all phases after 1 year's treatment. No clinical or serological relapse.
6. C. D. D., 24, Mar. 22, 1935, to Apr. 21, 1936.	7	do	3	3	2 plus	10	130	30	Spinal negative all phases after 13 months' treatment. No clinical or serological relapse.
7. S. D. L., 19, Apr. 2, 1935, to July 7, 1936.	4	do	2	13	3 plus	4	130	30	Spinal negative all phases at end of 15 months' treatment. No clinical or serological relapse.
8. W. W. B., 23, Apr. 29, 1935, to May 22, 1936.	6	do	5	31	2 plus	5	130	30	Spinal negative all phases after 13 months' treatment. No clinical or serological relapse.
9. J. T. W., 23, Apr. 27, 1935, to Nov. 1, 1936.	7	do	3	21	Negative		130	30	Kahn remained negative throughout. No clinical relapse. Treatment very irregular. Spinal negative all phases after 17 months' treatment. Kahn remained negative throughout. Spinal negative all phases after 14 months' treatment. No clinical relapse.
10. B. J. L., 24, May 14, 1935, to July 31, 1936.	4	do	1	10	do		130	30	Kahn remained negative throughout. Spinal negative all phases after 13 months' treatment. No clinical relapse.
11. A. J. F., 22, May 20, 1935, to June 18, 1936.	1	do	1	5	do		130	30	Kahn remained negative throughout. Spinal negative all phases after 13 months' treatment. No clinical relapse.
12. M. B. B., 26, June 3, 1935, to June 9, 1936.	6	do	1	11	do		130	30	Kahn remained negative throughout. No clinical relapse. Spinal negative all phases after 1 year's treatment.
13. D. L. A., 33, June 5, 1935, to June 27, 1936.	16	Negative		8	3 plus	7	130	30	Primary on tongue. No clinical or serological relapse. Spinal negative all phases after 1 year's treatment.
14. N. F. B., 22, July 22, 1935, to July 28, 1936.	37	Positive	2	10	4 plus	20	130	30	Primary on lip. No clinical or serological relapse. Spinal negative all phases after 1 year's treatment.
15. P. W. D., 21, July 20, 1935, to Dec. 1, 1936.	5	do	1	8	do	4	130	30	Treatment started in secondary period. Spinal negative after 17 months of irregular treatment. No clinical or serological relapse.

16. K. F. O., 28, Aug. 19, 1935, to Dec. 1, 1936.	18.....	Negative.....	24.....	do.....	17.....	1 30	30	Spinal negative after 16 months of irregular treatment. No clinical or serological relapse. Treatment started in secondary period.
17. M. H. O., 24, Sept. 23, 1935, to Nov. 27, 1936.	5.....	Positive.....	13.....	do.....	30.....	1 30	30	Treatment irregular. Kahn remained 4 plus to June 9, 1936; then 2 plus to Oct. 1, 1936; then negative. No clinical relapse. Spinal negative after 14 months' treatment.
18. S. N. A., 30, Sept. 24, 1935, to Aug. 10, 1936.	19.....	do.....	11.....	2 plus.....	3.....	1 30	20	No clinical or serological relapse to date. Lost from observation in eleventh month. Spinal not done.
19. B. A. E., 29, Oct. 10, 1935, to Oct. 17, 1936.	78.....	.....	.....	4 plus.....	10.....	1 30	30	Chancres healed when admitted in secondary stage. No relapse to date. Spinal negative all phases after 1 year's treatment.
20. R. H. F., 29, Oct. 20, 1935, to Jan. 10, 1937.	22.....	.....	.....	do.....	11.....	1 30	30	Chancres healed when admitted in secondary period. No relapse to date. Spinal negative all phases after 14 months' treatment.
21. B. R. W., 24, Oct. 29, 1935, to Jan. 14, 1936.	24.....	Positive.....	1.....	3 plus.....	8.....	1 10	8	Escaped from observation after 14 weeks' treatment. No relapse to date last seen.
22. M. F. E., 26, Oct. 30, 1935, to Nov. 17, 1936.	21.....	.....	.....	4 plus.....	10.....	1 30	30	Primary on tongue, healed when admitted in secondary period. No relapse to date. Spinal negative all phases after 13 months' treatment.
23. G. F. M., 22, Nov. 5, 1935, to Dec. 11, 1936.	17.....	Positive.....	2.....	do.....	10.....	1 30	30	No relapse to date. Spinal negative all phases after 13 months' treatment.
24. A. R., 46, Dec. 10, 1935, to Dec. 15, 1936.	9.....	do.....	2.....	Negative.....	.....	1 30	30	Spinal negative all phases after 12 months' treatment. No relapse to date. Kahn has remained negative throughout.
25. P. F. L., 24, Jan. 16, 1936, to Dec. 15, 1936.	10.....	do.....	1.....	1 plus.....	4.....	1 30	25	Spinal not yet done. Primary on lip. No relapse to date.
26. C. L. T., 20, Feb. 20, 1936, to Dec. 15, 1936.	29.....	do.....	1.....	4 plus.....	6.....	1 30	20	Do.
Average, 26.4.....	17.....	.....	1.5.....	13.3.....	9.7.....	4 29.6	.....	.....
¹ Total, 1,780 milligrams.		² Total, 2,380 milligrams.		³ Total, 580 milligrams.		⁴ Total, 1,686 milligrams.		

No instance of clinical and only one of serological relapse has been observed. Case no. 3 showed serological relapse in the eighteenth month, has remained negative since the twentieth month.

Twenty-two patients have completed 1 year's treatment, including 30 injections each of arsenoxide and bismuth salicylate.

Spinal-fluid examination (after a year's treatment) has been accomplished in 19 of the 22 cases just mentioned. In all the 19 cases the spinal fluid was negative in all phases.

There is very little to be said about toxic reactions among this group because nothing but the most negligible types of reaction were seen. Mild Herxheimer reactions were observed following the initial dose in two secondary cases and one late primary case. Subsequent injections produced no further reactions in any of these three cases.

In addition to the 26 cases in the series reported here, 19 others were selected for arsenoxide treatment for special reasons. Eighteen of these were selected because of reactions to the arsphenamines. The 18 cases of intolerance for the arsphenamines included two men with histories of latent syphilitic infections of several years' duration, persistent positive serology, and attacks of dermatitis following even the smallest doses of neoarsphenamine or arsphenamine. Dermatitis was produced in both these cases by 0.1 g of arsphenamine. They were both able to take arsenoxide in courses of 10 weekly injections in doses up to 20 and 40 mg respectively, without the production of frank dermatitis although both showed some mild erythema and itching about the axillae while under treatment. The erythema and itching would abate about the third day after each injection, only to reappear a few hours after the next injection. The serology was unaffected in these cases. The other 16 cases were women in the out-patient department who were unable to take neoarsphenamine because of the headache, nausea, vomiting, diarrhea, and fever that followed each injection. All 16 of these women offered no complaints following the mapharsen injections in doses from 40 to 60 mg, and at this writing have received an aggregate of 176 injections. A total of 982 injections has been given to a total of 45 patients with no reaction worthy of report in accordance with instructions in the Manual of the Medical Department.

In one case (no. 23) there was moderate nausea and diarrhea for several hours following four of the 60 mg injections in the second course. The dose was then reduced to 40 mg without further reactions and in his third course the dose was returned to 60 mg without reaction. In about a dozen cases the patients mentioned a dull ache in the shoulder of the injected arm which lasted from one to several hours after the injection. None found this very objectionable and all were eager for the next injection the following week.

Certain of the cases presented some unusual features which are thought of sufficient interest to mention here.

Case 3, admitted February 19, 1935, in an intense florid secondary stage showed what was either a multiple infection or a super infection. Following exposures on January 1 and 15 to the same source of infection he had developed a chancre of the lip on January 22, chancre of the penile shaft on February 10, and two chancres of the scrotum on February 17. On admission he showed a florid generalized rash, generalized adenopathy, marked submaxillary adenopathy, mucous patches over the palate and pharynx, and complained of considerable headache and malaise. Dark fields from all lesions were positive. He was given a 40-mg injection of arsenoxide on the day of admission. The next morning the dark fields were negative. By February 28 he had received three injections (total 160 mg) and by March 4 the chancres had healed, the rash faded, and the adenopathy subsided. The Kahn, 4 plus on admission, was 3 plus after the sixth injection, again 3 plus after the ninth injection, 1 plus after the tenth injection (when 10 injections of bismuth had also been given) and negative after the thirteenth injection. Serological relapse (3 plus) occurred in the eighteenth month but there has been no clinical relapse. Serology has again remained negative since the twentieth month. After 1 year's treatment, the spinal fluid was Kahn negative, cells 0, Pandy negative, gold curve 0000000000.

Case 9 is one in which serious lapses of treatment did not result in any serological or clinical relapse. He was admitted April 27, 1935, in a seronegative primary period. The dark field was positive until the third day after the first injection and a few hours after the second injection. Treatment continuity was maintained until September 28 at which time he had received 16 injections of arsenoxide and 10 of bismuth. He was not seen again until March 3, 1936, when the serology was still negative and there had been no signs of clinical relapse. Treatment also lapsed from March 24 to May 2, 1936, without apparent trouble.

Case 16 is cited because of two rather long lapses in the continuity of treatment, despite which the serology remained negative. About August 1, 1935, the patient noticed an ulcer at the frenum and a week later two others appeared in the coronal sulcus. On August 15 the secondary rash was observed, and a Kahn was done which was 4 plus. On August 17 he was admitted to the hospital, the primary lesions being then nearly healed, and the dark fields negative. The chancres were healed and the rash faded within 3 days after the second injection of mapharsen. The Kahn became 3 plus after the sixth injection, 2 plus after the tenth injection, and negative after the seventeenth injection. It remained negative from then on, despite a lapse of 5 weeks between the second mapharsen course and

second bismuth course and another lapse of 7 weeks between the second bismuth course and third mapharsen course.

Case 17 is cited because it is the only one in which complete serological reversal was not accomplished until the thirtieth injection had been given. Treatment was started in the seropositive primary period, about 1 week after the asserted appearance of the lesion. The dark field became negative within 24 hours after the first injection, and the chancre healed after the second injection. There was an unfortunate break in the treatment continuity amounting to 7 weeks between the seventh and eighth bismuth injections during the first course, this resulting in a lapse of nearly 3 months between the first and second mapharsen courses. There was another lapse of 3 months between the second and third mapharsen courses. The Kahn became 2 plus after the twentieth injection of mapharsen and remained negative after the thirtieth injection.

Case 19 is reported because it is the one in which the longest period elapsed between the initial appearance of the primary lesion and the beginning of treatment (78 days). On admission the primary sore had healed, diagnosis being made on the basis of mucous patches over the palate and buccal mucosa, generalized rash, generalized adenopathy, and 4 plus Kahn. The rash had faded, the mucous patches cleared and the adenopathy subsided after the fourth injection of mapharsen. The Kahn became 3 plus after the tenth injection and became negative during the first bismuth course, before the second course of mapharsen had started. It has remained negative to date and there have been no signs of clinical relapse.

SUMMARY AND CONCLUSIONS

1. The animal experimental work of Tatum and Cooper (3) and of Gruhitz (4), and the clinical trials by Foerster et al. (6), indicate that mapharsen in doses of about one-tenth that of the customary dose of neoarsphenamine is a drug well tolerated and of high spirocheticidal power.
2. Twenty-five cases of early syphilis are presented in which continuous or nearly continuous treatment with alternating courses of mapharsen and bismuth was given for 10 to 23 months, to the exclusion of all other treatment.
3. These cases showed rapid spirochetal death by dark fields, rapid healing of surface lesions, rapid serological reversals, almost perfect serological negativity maintenance and perfect prevention of clinical relapse.
4. Of 22 in which 1 year's treatment has been completed, spinal fluid examination has been made in 19, each fluid being negative in all phases. The highest cell count in any fluid was five, except one contaminated by R. B. C.

5. None of this series showed any but the most negligible types of reaction. Nineteen other cases are cited in which there was such intolerance for the arsphenamines that that type of arsenical was impossible to use. These 19 patients were able to take mapharsen in doses ranging from one-half to the full therapeutic equivalent of arsphenamine without mishap.

6. The results obtained in these cases indicate that mapharsen will gain and retain a high place among antisyphilitic agents.

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THE APPLICATION OF MEASUREMENTS OF NITROGEN ELIMINATION TO THE PROBLEM OF DECOMPRESSING DIVERS^{1 2}

By ALBERT R. BEHNKE, Lieutenant, Medical Corps, United States Navy

For the purpose of gaining a better understanding of the physiologic aspects underlying the decompression of deep-sea divers quantitative studies have been made in this laboratory in cooperation with the Bureau of Medicine and Surgery. The purpose of this paper is to present the results of measurements of nitrogen absorption and elimination in dogs and in man over a period of 2 years, and to apply

¹ From the Department of Physiology, Harvard School of Public Health, Boston, Mass.

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these results to the problem of decompressing workers in compressed air.

The prevention of compressed-air illness depends upon the elimination from the blood without bubble formation of the excess nitrogen absorbed during exposure to increased barometric pressure. The formulation of decompression tables for this purpose requires a knowledge of the rate of nitrogen absorption and elimination with changes in barometric pressure, the nitrogen content of the body, the substances in which the nitrogen is dissolved, and the degree to which these substances can hold nitrogen in supersaturation.

The fundamental studies of Paul Bert (1878), Heller, Mager, and von Schrotter (1900), and Boycott, Damant, and Haldane (1908) led to a better understanding of the cause, prevention, and treatment of compressed-air illness. Deep-sea diving has been made comparatively safe by the adoption of the decompression tables formulated by Boycott, Damant, and Haldane, and the hazards of work in compressed air have been minimized as a result of a practice of decompression evolved from extensive tunneling projects in New York State (Levy, 1922). Empirical rather than quantitative data, however, formed the basis for the formulation of decompression tables. Thus, two of the basic assumptions underlying the diving tables are that the absolute pressure can be safely halved during the first stage of decompression, and that about 5 hours are necessary for the complete absorption or elimination of nitrogen from the body.) While these assumptions were derived from and their accuracy tested by animal experimentation and by work in compressed air, there were no actual determinations of the ability of the tissues to hold nitrogen in supersaturation, or of the time required for nitrogen elimination in man.

Fifty-three years after proof had been adduced by Bert that nitrogen bubbles cause compressed-air illness, Campbell and Hill (1931) measured the nitrogen eliminated by man when oxygen was breathed for short periods of time at normal barometric pressure, and later (1933) contributed valuable quantitative data with reference to nitrogen absorption and solubility in the brain, liver, and bone marrow of the goat. The necessity for these studies is indicated by the occurrence of occasional accidents when the standard diving tables have been followed, particularly after prolonged exposures to high pressures. An inquiry into the cause of these accidents revealed the need for additional quantitative data with reference to nitrogen absorption by and elimination from the body during exposure to and decompression from high air pressures respectively.

Definition of terms.—Saturation implies a condition of equilibrium between the nitrogen absorbed by the body and that present

in the lungs. Partial saturation implies that this equilibrium has not been reached, hence, the body can absorb more nitrogen. Percentage saturation is the ratio multiplied by 100 between the partial pressure of nitrogen in the body and the partial pressure of nitrogen in the lungs. The partial pressure of nitrogen is regarded as proportional to the volume (measured under standard conditions) of nitrogen in the body; 50 percent saturation implies, therefore, that one-half of the equilibrium pressure has been reached, since one-half of the volume of nitrogen corresponding to saturation has been absorbed. The excess pressure in the body refers to the increase in the nitrogen tension above that which normally exists at atmospheric pressure, and is approximately 79 percent of the gage pressure. The absolute pressure is gage pressure plus 14.7 pounds (1 atmosphere). Difference in pressure refers to the difference between the average partial pressure of nitrogen in the body and in the lungs. It is a measure of the pressure head at which nitrogen diffuses from the body into the lungs or vice versa.

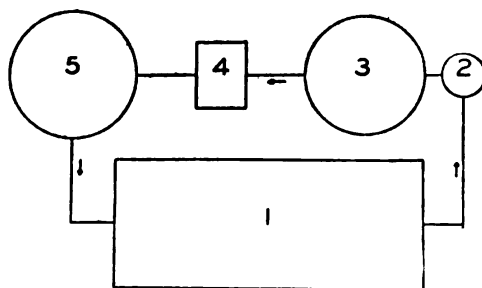


FIGURE 1.—Diagram of a closed system devised by Shaw et al. (1935) in which the nitrogen dissolved in the body can be removed by breathing pure, circulating oxygen. (1) metal box with mercury seal, (2) soda lime canister, (3) spirometer, (4) blower, and (5) cooling coil.

Fundamental principles.—The nitrogen dissolved in the body can be removed by oxygen inhalation, which reduces the partial pressure of nitrogen in the lungs to a value approaching zero. For this purpose Shaw and his associates (Shaw, Behnke, Messer, Thomson, and Motley, 1935) used a closed 100-liter system (fig. 1) consisting of a metal box (1), soda lime canister (2), spirometer (3), blower (4), and a cooling coil (5). In a typical experiment an anesthetized dog (dial-urethane solution introduced intraperitoneally) was placed in the metal box (1) through which oxygen circulated. Since the concentration of oxygen did not fall below 99 percent, practically complete nitrogen elimination was assured over a period of hours. During all but the first 7 minutes the eliminated nitrogen could be measured by analyzing periodic gas samples and multiplying the nitrogen percentage by the volume of the system. During the first 7 minutes the air in the apparatus and in the dog's lungs was replaced

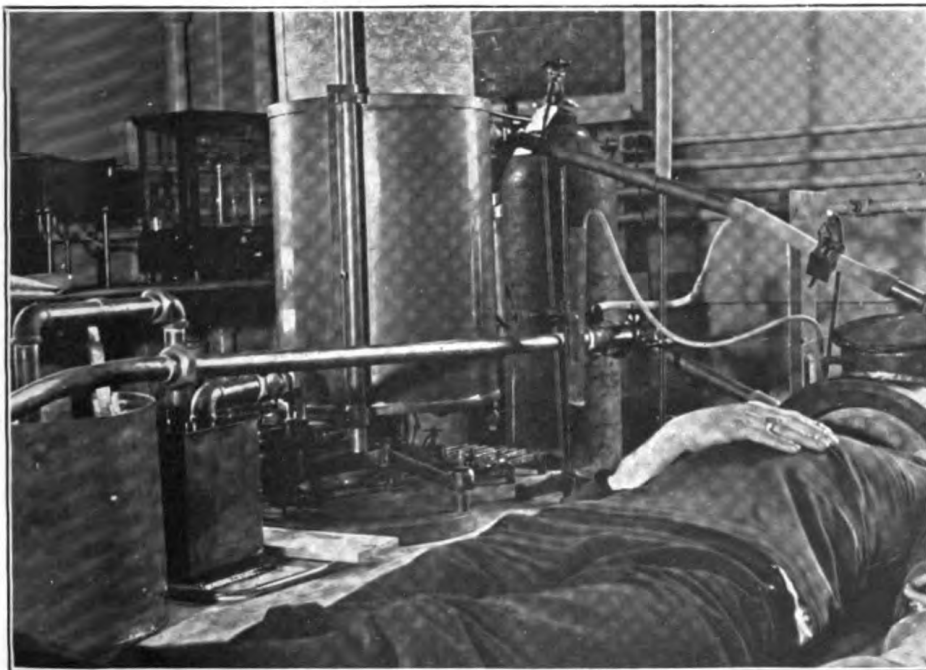
by oxygen. With this procedure it was found that about 95 percent of the total nitrogen was eliminated in 2 hours, and 100 percent in 3 hours (lean dogs). The normal nitrogen content of a lean dog was approximately 14 cc per kilogram of body weight.

Three generalizations were now subjected to quantitative test: (1) The quantity of nitrogen absorbed by the body when equilibrium is reached is proportional to the partial pressure of nitrogen in the lungs—an application of Henry's law; (2) with the same pressure head the rate of nitrogen absorption is equal to the rate of nitrogen elimination; and (3) the time required for the complete desaturation of the body and the percentage rate of elimination are the same irrespective of the initial quantity of nitrogen in the body.

The application of Henry's law to the absorption of nitrogen by the body was tested by subjecting the dog to pressures of 3 and 4 atmospheres for a period of 4 hours, respectively, in order to make certain of complete saturation. The dog was then placed in the metal box at atmospheric pressure, and the nitrogen which had been absorbed at the high pressures was measured. A comparison of the results showed that within the limits of experimental error nitrogen absorption is proportional to the partial pressure of nitrogen in the lungs.

Rate of saturation compared with the rate of desaturation.—A dog rendered completely nitrogen free by long exposure to oxygen alone was exposed for 67 minutes in air at a pressure of 4 atmospheres. The nitrogen absorbed at this pressure was found to be equal to the nitrogen eliminated by the dog during the same period of time when the pressure head of nitrogen was reversed, i. e., nitrogen tension in the dog's body equivalent to 4 atmospheres, and in the lungs 0.

Nitrogen elimination in relation to the quantity of nitrogen absorbed.—In figure 2, curve A represents the nitrogen eliminated from a dog which had been exposed to a pressure of 4 atmospheres for 120 minutes after having been previously rendered nitrogen free; curve B follows an exposure to a pressure of 4 atmospheres for 37 minutes; and curve C follows complete saturation (240 minutes) at a pressure of 1 atmosphere. All of the nitrogen measurements were obtained from the same dog. It will be observed that not only is the time for nitrogen elimination practically the same following complete (C) or partial (A and B) saturation, but also the percentage rate of nitrogen elimination for corresponding periods of time is the same within the limits of experimental error as shown by the slope of the lines A, B, and C. Thus, the nitrogen absorbed after an exposure of 37 minutes to a pressure of 4 atmospheres is not eliminated any faster than the nitrogen absorbed after a 2-hour exposure to the same pressure although the total amount given up is less.



APPARATUS FOR THE MEASUREMENT OF NITROGEN ELIMINATION FROM THE BODY.

The units are designated in Fig. 1. For man, a helmet has replaced the box (1).

The nitrogen solvents of the body, and the fat and lipoid content of the brain, spinal cord, and bone marrow.—It has been generally assumed that the chief nitrogen solvents of the body are fat and water. The correctness of this assumption was checked by determining the fat and water content of a dog and by multiplying the results by the solubility coefficients of nitrogen in fat and in water, respectively. The nitrogen content computed in this manner agreed with the quantity of nitrogen previously determined in vivo during the breathing of oxygen. The fat and lipoids were then extracted with carbon tetrachloride from the brains and spinal cords of five

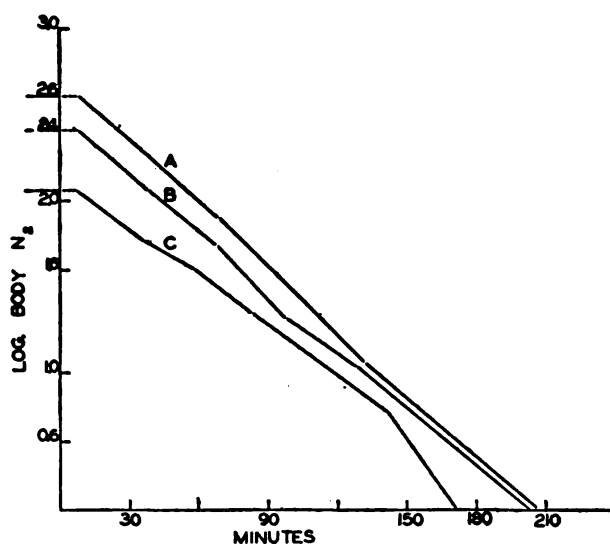


FIGURE 2.—Decrease in the nitrogen content of the dog's body during oxygen breathing in (1) figure 1, at atmospheric pressure. A, after exposure to a pressure of 4 atmospheres absolute for 120 minutes; B, after exposure to 4 atmospheres for 37 minutes; and C, after exposure to 1 atmosphere for 240 minutes (complete saturation). Ordinates represent the logarithms of the values in cc of the nitrogen content of the body.

dogs. In table 1 the results are tabulated. In the calculation of the nitrogen content a solubility coefficient of 0.00954 was used for water, and 0.055 for fat. The solubility coefficient represents the number of cc of nitrogen dissolved per gram of water or fat at 38° C. and 570 mm. For water, the computation of the coefficient is based upon the measurements of Van Slyke, Dillon, and Margaria (1934), and for fat, upon the measurements of Campbell and Hill (1931).

Summary of fundamental principles.—The nitrogen dissolved in the body can be removed by breathing pure oxygen. Using this method to measure the nitrogen elimination in dogs exposed to pressures as high as 5 atmospheres absolute, it was found: (1) that nitrogen absorption is proportional to the partial pressure of nitrogen in the lungs; (2) that with the same pressure head the rate of nitrogen absorption is equal to the rate of nitrogen elimination; and (3)

that the time for complete nitrogen elimination and the percentage rate of nitrogen elimination for corresponding periods of time are the same irrespective of the quantity of nitrogen absorbed by the body. Additional data were advanced to show that the body nitrogen is soluble in fat, lipoids, and water; that the brain contains about 5 grams of fatty material compared with 28 grains in the spinal cord. It was also shown that the quantity of nitrogen in a lean dog is about 14 cc per kilogram, and that this nitrogen is eliminated in about 3 hours when oxygen alone is breathed by the anesthetized dog. With these basic facts in mind we can consider the next phase of the problem.

Measurements of nitrogen elimination in man.—Measurements of nitrogen elimination on men were conducted at atmospheric pressure with apparatus similar in construction to that used for dogs as shown in the photograph. The results from seven young men who breathed oxygen for periods of 4 to 6 hours are summarized in tables 2 and 3. The data in table 2 show that 6 men of approximately the same weight eliminated from 12.3 to 14 cc of nitrogen per kilogram. In appearance these men were lean but well developed. The seventh man was moderately fat and the high value of 18.6 cc of nitrogen per kilogram reflects this condition.

The nitrogen eliminated by subjects B. U. R., R. O. M., and T. H. O. during the first 5 minutes while oxygen was replacing the air in the apparatus was calculated by extrapolating the experimental curve to the left for the corresponding period of time (Behnke, Thomson, and Shaw, 1935). In calculating the percentage of the total nitrogen eliminated by these subjects it was assumed that 95 percent of the total nitrogen is eliminated in 4 hours. This assumption is supported by the fact that in dogs 95 percent desaturation requires 2 hours and that 99 desaturation requires about 3 hours. Since the circulatory rate of the dog is about twice that of man per kilogram of body weight, it is not unreasonable to assume that 95 and 99 percent saturation will take twice as long for man. This assumption is further supported by experiments with subjects B. I. L., M. U. R., and F. A. H., in whom complete nitrogen elimination was effected within the limits of experimental error in 6 hours. The experimental errors caused a variation of ± 7.5 cc so that the elimination of quantities of nitrogen of less than 7.5 cc per hour could not be accurately measured. Although the precise end-point for nitrogen elimination cannot be determined, a value of 95 ± 2 percent can be used with reasonable certainty as the percentage of nitrogen eliminated by the body at the end of 4 hours, and 98 ± 2 percent for the amount given up at the end of 6 hours.

Analysis of a nitrogen elimination curve.—Figure 3 shows graphically the way in which nitrogen is eliminated by lean, well-developed men while breathing pure oxygen for a period of 6 hours. The experimental values which determine the total nitrogen curve (A) are the average of the values from subjects B. I. L., M. U. R., and

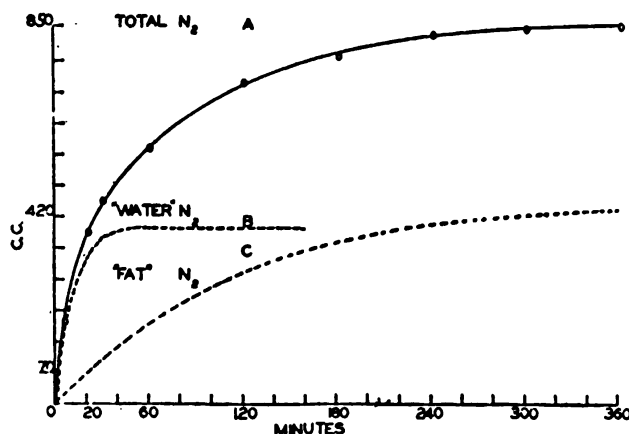


FIGURE 3.—Total N_2 , A, represents the average of the values for nitrogen elimination from 3 men (average weight 64 k) who breathed pure oxygen at atmospheric pressure. "Water" N_2 (B) and "Fat" N_2 (C) are hypothetical curves showing the absorption or elimination of nitrogen by the body solvents. The values for nitrogen on A are approximately the sum of corresponding values on B and C, see table 4.

F. A. H. (see table 4). If the blood flow throughout the body was distributed uniformly with respect to the nitrogen content of the tissues, the values of curve A could be derived from an exponential equation of the form,

$$Y = A (1 - e^{-kt}) \quad (1)$$

which states the relationship that the quantity of nitrogen eliminated from the body at any instant is proportional to the nitrogen content of the body at the given instant. In the equation, Y = the amount of nitrogen eliminated during the time interval t ; A = the initial nitrogen content of the body; k = the rate of change in the slope of the curve; and e , the natural base of logarithms. The expression, $1 - e^{-kt}$,³ gives the percentage decrease of nitrogen in the body during the time interval t . If the experimental values for nitrogen elimination on curve A be substituted in equation (1), the value of k does not remain constant but progressively decreases, as shown by table 3, columns 9 and 18. This is explained by the fact that the blood flow is not distributed uniformly in relation to the distribution of nitrogen in the body particularly with reference to fat which has a high nitrogen capacity and a poor blood supply.

³ For values of 0.05 or less, k and $(1 - e^{-k})$ are almost the same, so that k may also be considered as the percentage rate of nitrogen elimination per unit of time.

Thus, at the start of oxygen breathing the average nitrogen tension in the blood is equal to the nitrogen tension (partial pressure) in the different tissues of the body, and a maximum load of nitrogen is eliminated per unit of time. As the experiment progresses, the average nitrogen tension in the blood tends to fall below the nitrogen tension in the slowly saturating or fatty tissues. Consequently the percentage rate of nitrogen elimination decreases.

If the total nitrogen of the body is divided according to its solubility in water and in fat, then equation (1) with a constant value for k can be conveniently employed to represent nitrogen absorption by or elimination from water and fat, respectively.

Thus, if the elimination of nitrogen from fat is assumed to proceed at a uniform percentage rate (constant value for k), the approximate quantity of nitrogen given up by fat can be calculated in the following manner: since 98 ± 2 percent nitrogen elimination requires 6 hours, and since fat per unit volume contains five times more nitrogen than water, it should take fat at least five times longer to eliminate its nitrogen. The nitrogen, therefore, eliminated after the first hour (curve A), 275 cc, was initially present in fat. The nitrogen eliminated from fat during the first hour (182 cc) can now be calculated from equation (1), in which $t = -60$, $A = 275$, and $k = 0.0085$ —a value computed from an experimental curve similar to A, figure 3, by Behnke, Thomson, and Shaw (1935). Total nitrogen from fat is equal to $(182 + 275)$ 458 cc. Subtracting 458 from 850 (the total nitrogen content of the body), a value of 392 cc is obtained for the nitrogen in the body fluids. The absorption or elimination of nitrogen by the body can now be represented by an equation consisting of two components, one for water, and the other for fat:

$$Y = 392(1 - e^{-0.0085t}) + 458(1 - e^{-0.0085t}) \quad (2)$$

in which the value of k for water is also obtained from the calculations of Behnke et al. The curves representing the water and the fat components of equation (2) are drawn in figure 3 as B and C, respectively. In table 4 the experimental values for the elimination of body nitrogen are compared with the values calculated by equation (2); the agreement appears to be satisfactory.

The interpretation placed upon the "fat" and "water" curves.—The curves B and C are only approximations of the manner in which nitrogen is absorbed by or eliminated from its chief body solvents. They should not be interpreted to mean that fat and water exist as separated entities in the body, but rather that the fat, lipoids, and water are so distributed that during saturation a large part of the nitrogen absorbed by fat and lipoids diffuses from the body fluid. On decompression the reverse process is thought to occur. Thus

during decompression following partial saturation the diffusion of nitrogen from the rapidly saturating body fluids into the slowly saturating lipoids and fat tends to equalize the partial pressure of nitrogen in the different tissues of the body. With the exception of tissues with a high fat content (fat deposits, bone marrow, and spinal cord) the division of the body into tissues which saturate or desaturate at different rates is largely arbitrary, and the body can be regarded essentially as a unit. This fundamental concept can be made more clear by comparing the body to a beaker of water in which is distributed fat, with a greater concentration of fat in the lower portion. If the beaker is now exposed to a high nitrogen pressure for a short period of time and then quickly returned to atmospheric pressure, diffusion of nitrogen will take place from the water into the surrounding air and also into the unsaturated water and fat present in the beaker. In the body after short exposures (up to 30 minutes) to high pressures the fat acts as a nitrogen absorbent during decompression and serves as a buffer against bubble formation in the blood stream. Fat men, consequently, with adequate blood circulation should be better suited for short exposures in compressed air than lean men.

APPLICATION OF THE EXPERIMENTAL RESULTS

Duration of exposure to increased pressure followed by immediate decompression to atmospheric pressure.—It is important not only in diving but also in submarine escape drills to know the duration of exposure to various depths which can be followed safely by immediate ascent to the surface, i. e., without decompression stops. In the dog experiments it was observed that the percentage rate of nitrogen elimination for corresponding periods of time did not vary with the quantity of nitrogen absorbed, since the slope of the curve following saturation (fig. 2) was the same as the slope of the curve following incomplete saturation. It follows as a corollary that the same curve will represent the elimination of a given quantity of nitrogen irrespective of whether the nitrogen is absorbed at a low pressure over a long period of time or at a high pressure for a short period of time. If use is made of the well-established fact that compressed-air illness (excessive nitrogen bubble formation) rarely occurs with rapid decompression, even after prolonged exposures to an excess pressure of 19 pounds (Haldane, 1927), then the safe exposure time to excess pressures followed by rapid decompression can be calculated from the nitrogen elimination curve, figure 3, A, a segment of which is reproduced in figure 4 (the values of the ordinates have been expressed in terms of percentage saturation instead of cc of nitrogen). Thus, if a prolonged exposure (100 percent saturation) at an excess pressure of 19 pounds followed by immediate decompression is safe, then rapid decompression after 50 percent saturation at 38 pounds, or 25 per-

cent saturation at a pressure of 76 pounds, will also be safe, since after each exposure the same quantity of nitrogen has been absorbed. In tabular form:

$$\begin{aligned}
 P \times R &= K \\
 19 \times 100 &= 19 \\
 38 \times 50 &= 19 \\
 57 \times 33 &= 19 \\
 76 \times 25 &= 19
 \end{aligned}$$

where P represents the excess pressure in pounds, R , the percentage saturation of the body, and K , a value determined empirically which represents the level from which rapid decompression is safe following prolonged exposure. Figure 4 illustrates graphically the principle

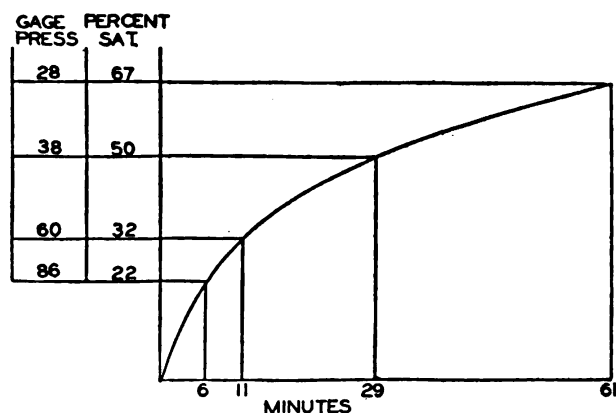


FIGURE 4.—Graphic method for calculating the duration of exposure to different gage pressures followed by immediate decompression to 0 lb. The curve is a segment adapted from A, figure 3, in which the ordinate values are expressed in terms of percentage saturation instead of cc of nitrogen.

underlying the calculations. Thus, for men with nitrogen elimination curves similar to figure 3, 50 percent saturation requires 29 minutes and 32 percent saturation 11 minutes. It would be safe, therefore, to remain at a depth of 85 feet for a period of 29 minutes and at a depth of 133 feet for 11 minutes. The results of these calculations have been confirmed for depths between 25 and 55 meters, as reported by Kagiya (1934), whose results follow:

Gage pressure	Feet	Time
36.5	82	30
46.8	105	20
58.4	131	20
65.9	148	15
73.1	164	15
80.2	180	10

Undoubtedly somewhat higher values for K may be used in the calculations in view of the experience of Japp (1909).

Decompression of compressed-air workers.—The stage method of decompression devised by Boycott, Damant, and Haldane (1908) for the purpose of bringing divers safely to the surface has been so extensively adopted that the term “standard” is applicable to the tables formulated by these authors. The standard practice of decompression, however, does not prevent compressed-air illness in every case when exposures at high pressures are prolonged. There is urgent need for a modification of the standard table or for a new table which will prevent this trouble. In table 5 are listed the reactions of A. R. B. which are typical of the symptoms following prolonged exposure at a pressure of 45 pounds when decompression is governed

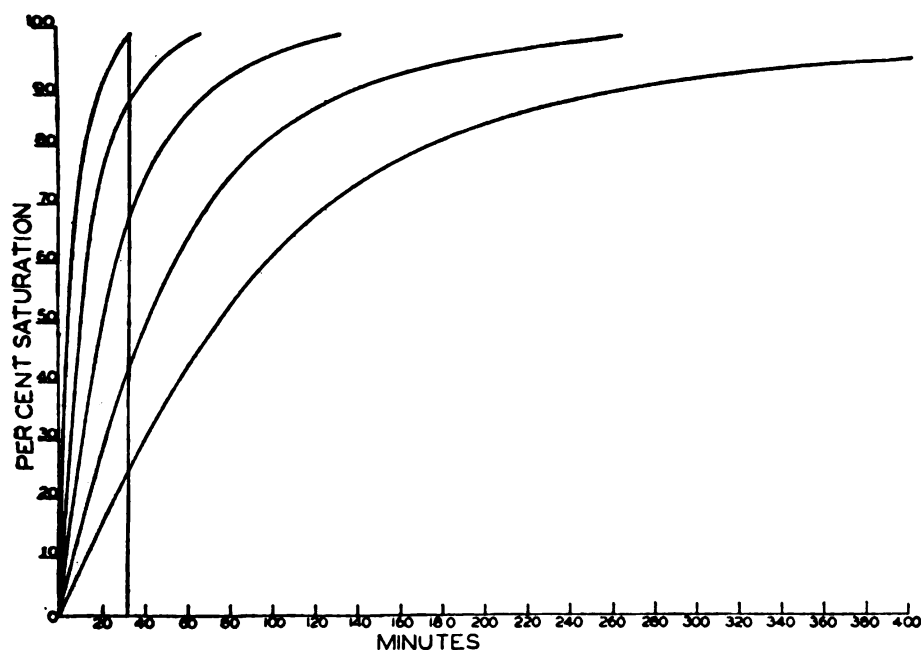


FIGURE 5.—The division of the body into 5 tissues which half saturate in 5, 10, 20, 40, and 75 minutes, respectively, is represented by the curves. This division forms the basis for calculating the standard decompression table for divers. For example, after an exposure to any gage pressure for 31 minutes the percentage saturation of each tissue is determined from the point of intersection of the perpendicular line with the curve representing the saturation of the tissue. Compare with figure 8.

by the standard table. (See Haldane (1927) and the United States Naval Diving Manual (1924).) The pulmonary symptoms (table 5) are thought to arise from nitrogen bubbles in the pulmonary vessels, while pain in the extremities is probably the result of intravascular bubble formation in the bone marrow. The question arises, what is the cause of bubble formation under these conditions?

The analysis of this problem requires a consideration of the correctness of the two fundamental assumptions upon which the standard table is based, namely, that about 4 hours are required for that part of the body with the lowest rate of nitrogen elimination to give

up 94 percent of its nitrogen, and that the absolute pressure in the most rapidly saturating part of the body can be immediately halved. In the calculations of the standard table the body is arbitrarily divided into five tissues which half-saturate in 5, 10, 20, 40, and 75 minutes, respectively, as shown in figure 5. For example, after a diver has been exposed to any excess pressure for 31 minutes, the percentage saturation of each of the five tissues would be computed from the points of intersection where the line perpendicular to the abscissa crosses the curves. [During the first stage of decompression the air pressure is abruptly decreased until a ratio of 2 to 1 exists between the absolute pressure in the most rapidly saturating tissue and the absolute pressure in the lungs. Subsequent decompression is then carried out in slower stages so that the 2 to 1 or 2.3 to 1 ratio is not exceeded in any of the five tissues.]

Decompression on this arbitrary basis does not take into consideration the diffusion of nitrogen from a high pressure level in the rapidly saturating tissues to a low pressure level represented by the slowly saturating tissues, or actually from the body fluids into the body fat. [Decompression, therefore, may be unnecessarily prolonged following short exposures in compressed air. This, however, is not an adverse criticism since the wide margin of safety has prevented diving accidents following the usual time limits of exposure to excess pressures. The division of the body into five tissues forms a comprehensive classification, and in part receives experimental confirmation from the fact that the rate of change in the slope of the nitrogen elimination curve progressively diminishes as shown by the k values in table 3, columns 8 and 17. Moreover, the assumption that the slowest desaturating tissue in figure 5 gives up 50 percent of its excess nitrogen in 75 minutes (94 percent in 4 hours, and about 97 percent in 7 hours) is supported by the experimental finding that the body as a whole is 98.2 percent desaturated in 6 hours. It is indeed remarkable that the quantitative data have so precisely confirmed the brilliant analysis of Boycott, Damant, and Haldane with respect to the desaturation time for that part of the body with the lowest rate of nitrogen elimination.] It is therefore unlikely that compressed-air illness following long exposures to high pressures results from an underestimation of the time required for nitrogen elimination.

With regard to the second assumption it would appear that the safety with which the absolute pressure can be halved depends entirely upon the degree of saturation of the body as a whole when decompression starts. Figure 6 represents the first stages of decompression after a dive has been made to a depth of 100 feet. The curve is adapted from A, figure 3, and shows the manner in which the body as a whole comes into equilibrium with a gage pressure corre-

sponding to a depth of 100 feet. The first stop, for example, in decompression according to the standard method after an exposure of 15 minutes to a depth of 100 feet is at a depth of 20 feet and corresponds to approximately one-half the absolute pressure in the most rapidly saturating tissue in the classification of figure 5. From 15 to 60 minutes the first stop is at 30 feet, and after the first hour at 40 feet. It will be observed that as the time of exposure increases, the degree of saturation, and consequently, the average nitrogen pressure in the body also increases so that the difference between the pressure in the body and the lungs at the first stop becomes progressively greater.

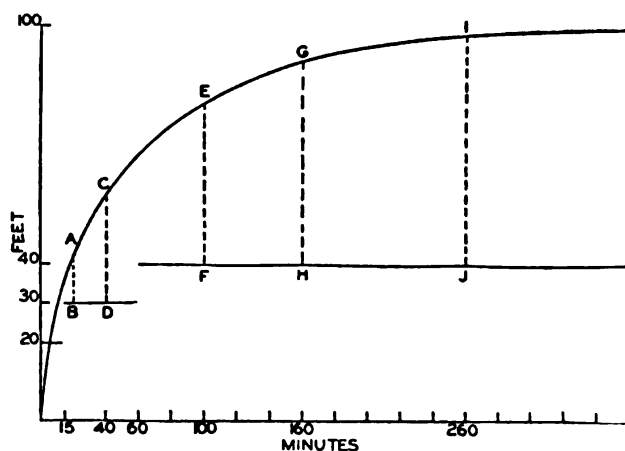


FIGURE 6.—The curve is adapted from A, figure 3, and represents the rate at which the pressure in the body approaches equilibrium with the gage pressure corresponding to a depth of 100 feet. The relative difference in pressure at the first state in decompression (standard procedure) between the body and the lungs is represented by the broken lines for corresponding periods of exposure.

Thus, while a difference in pressure represented by A-B or C-D may be safe, the difference in pressure E-F or G-H may result in bubble formation especially if such pressure is maintained for a considerable period of time. The proof that the absolute pressure can be safely halved is not demonstrable by short exposures up to 20 or 30 minutes since during so short an exposure the body is only partly saturated with the fat containing less nitrogen than the water, and on decompression, diffusion of nitrogen will take place into the unsaturated fat as well as to the air. Tests for the validity of the assumption that the absolute pressure can be abruptly halved must therefore be made after the nitrogen tension in the body has come into equilibrium with the nitrogen tension in the lungs.

It should be stressed that the rapid decrease in pressure from 2.3 atmospheres absolute, or even 2.8 atmospheres (Japp, 1909) to 1 atmosphere without the development of serious symptoms of compressed-air illness does not mean that the same difference in pressure can be maintained for prolonged periods of time during decompression.

sion from higher pressure levels. The bubbles of nitrogen which might be tolerated by the body after rapid decompression from 2 to 1 atmospheres would lead to serious symptoms when formed after immediate reduction of the pressure from 6 to 3 atmospheres. This is due to the fact that nitrogen bubble formation retards the elimination of nitrogen from the blood since the nitrogen tension in a bubble is only slightly higher than the nitrogen tension in the lungs (Behnke and Shaw, 1935). As a result the nitrogen from the tissues accumulates in the blood stream in bubble form instead of being eliminated into the lungs. The seriousness of bubble formation is, therefore, proportional to the pressure head of nitrogen in the tissues at the time of bubble development.

Even under ideal conditions the supersaturated state of gases in liquids is extremely unstable and bubble formation consequently unpredictable. Any assumption that the blood in a state of continual motion or any other part of the body can hold nitrogen in supersaturation at a ratio of 2 to 1 in atmospheres absolute for prolonged periods of time should be subjected to rigid tests. In the meantime, it would appear advisable to produce in diving a constant difference in pressure expressed in pounds per square inch (10 to 15) between the average nitrogen tension in the body as determined from figure 3 or from similar curves, and the tension in the lungs. While a difference in nitrogen pressure between 10 and 15 pounds (represented by an air-pressure difference of 12 to 19 pounds) may appear too low particularly in the early stages of decompression, too much stress cannot be laid on the necessity of avoiding bubble formation when a high pressure head of nitrogen is present in the tissues. A low difference in pressure in the early part of decompression allows a necessary wide margin of safety, since, if subsequent decompression is too rapid, a considerable part of the body nitrogen will have been eliminated before bubbles form.

Decompression according to the New York State regulations.—As a result of 1,360,000 decompressions up to 1822 (Levy, 1922) and over 3,000,000 at the present time attended by a negligible number of accidents (6 cases per 100,000 decompressions), the decompression schedule of New York State serves as an excellent criterion for the evaluation of conclusions drawn from laboratory results. This schedule differs from that of the standard diving table in that the gage and not the absolute pressure is halved rapidly during the first stage of decompression and then more slowly at a uniform rate during the remainder of decompression. The duration of exposure, moreover, to excess pressures from 22 to 50 pounds is so reduced that when the gage pressure is halved a fairly constant difference not exceeding 13 pounds exists between the nitrogen tension in the body and the

nitrogen tension in the lungs. In figure 7 (an adaptation of curve A, fig. 3), for example, at a gage pressure (F) of 22 pounds the first work-shift lasts 4 hours during which time the body becomes 97 percent saturated with excess nitrogen. When the gage pressure is rapidly halved in the first stage of decompression a difference (F') of 10.3 pounds exists between the nitrogen tension in the body and in the lungs. It is observed that as the gage pressure is increased (E, D, C, B, and A) the work-shift is decreased so that the difference in pressure in pounds at the first stop (E', D', C', B', and A') remains about the same or decreases. It is believed that this comparatively low difference in pressure between the nitrogen tension in the body and in the lungs is an important factor in preventing compressed-air illness.

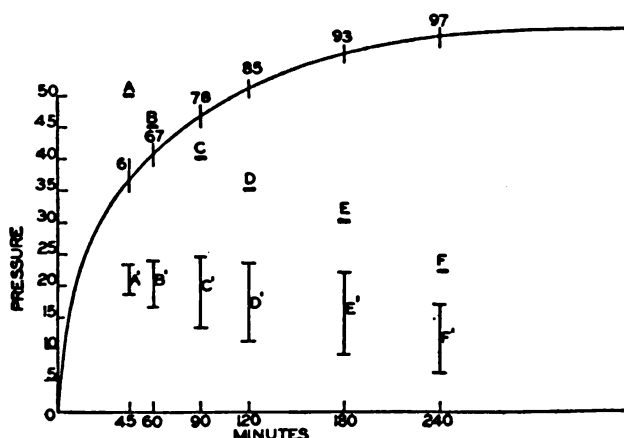


FIGURE 7.—The figures on the curve (adapted from A, figure 3) represent the percentage saturation of the body with excess pressure (A, B, C, D, E, and F) for corresponding work shifts (45, 60, 90, 120, 180, and 240 minutes) governed by the New York State regulations. A', B', C', D', E', and F' represent the relative differences in pressure between body and lungs at the first stage in decompression. Compare with figure 6.

Proposed method of decompression.—In the formulation of a decompression schedule from the laboratory data, the body is regarded not as five tissues with varying nitrogen tensions but essentially as a unit composed of fat and water in which the process of diffusion from water into fat or vice versa tends to equalize the nitrogen tension during saturation and desaturation. The nitrogen elimination curve, figure 3 and reproduced in figure 8 with the ordinate values changed to read in terms of percentage saturation, serves as the basis for the calculation of a decompression table for lean, well-developed men.

Decompression can be conveniently divided into two stages. During the first stage the pressure is lowered rapidly (15 pounds per minute) until a designated difference is created between the average nitrogen tension in the body and the nitrogen tension in the lungs. During the second stage the gage pressure is lowered at a uniform rate so

that this pressure difference is maintained at a constant value during the remainder of decompression./

The average nitrogen tension in the body is calculated by multiplying the percentage saturation by the partial pressure of nitrogen corresponding with the gage pressure. For example, after complete saturation during an exposure to a gage pressure of 100 pounds, the average nitrogen tension is (0.79×100) 79 pounds. After incomplete saturation, say 53 percent (31-minute exposure), the average nitrogen tension is (0.53×79) 41.8 pounds. Partial saturation at a high pressure is regarded as equivalent to complete saturation at a lower pressure. Thus, the same curve (B, fig. 8; B is adapted from curve A by reducing the ordinate values of A 47 percent)

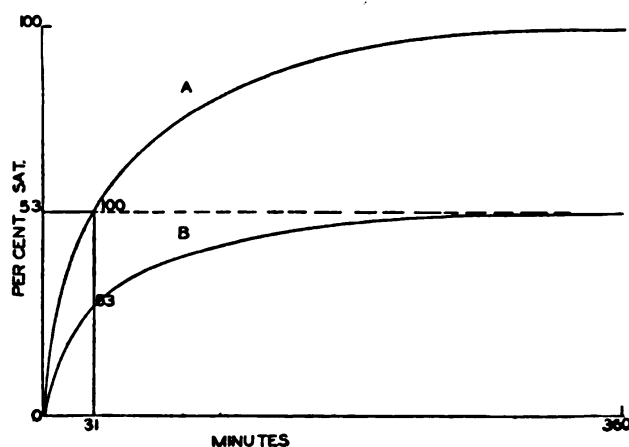


FIGURE 8.—Illustrates the proposed method of calculation for decompression of divers. After a dive of 31 minutes, for example, the percentage saturation of the body is 53 as shown on curve A (adapted from A, figure 3). If the gage pressure were lowered to 0 lb., the excess nitrogen would be eliminated according to curve B, the ordinates of which lie along the line perpendicular to the abscissa at 31 minutes. Compare with figure 5.

represents nitrogen elimination, when the pressure is dropped to 1 atmosphere, following either complete saturation with nitrogen at a pressure of 41.8 pounds, or 53 percent saturation at a pressure of 79 pounds. The basis for this concept is the experimental finding that the slope of the lines A, B, and C representing nitrogen elimination after different degrees of saturation (fig. 2) is the same for corresponding periods of time.

The safe difference in nitrogen tension that can be maintained between the body and the lungs during decompression depends upon the degree that nitrogen can be held in supersaturation by the blood and other tissues of the body. For the present this value must be estimated from empirical data with the provision that it may be modified as a result of diving or other tests. If rapid decompression from 19 to 0 pounds is safe (Haldane, 1927) then a difference

in nitrogen tension between the body and lungs of (0.79×19) 15 pounds will certainly be safe at any pressure level. From the analysis of the New York State Regulations a difference in nitrogen pressure of 10 pounds (air pressure 12.5 pounds) may be regarded as a probable minimum for maintenance during decompression. The probable value, therefore, which will not unduly delay decompression or produce bubble formation, lies between 10 and 15 pounds (12 to 19 pounds air pressure).

The rate at which the nitrogen tension in the body will decrease with a given difference in pressure between body and lungs depends upon the slope of the nitrogen elimination curve. The rate of decrease (k) diminishes during the progressive desaturation of the body as shown by the values in columns 9 and 18, table 3. For example, during the first 6 minutes the body eliminates an average of 4 percent per minute of the excess nitrogen. Over a period of 21 minutes the percentage rate decreases to 3, and over a period of 121 minutes the average percentage rate drops to 1.5. / This decrease in the percentage rate of nitrogen elimination is undoubtedly due to the presence of tissues which have a poor blood supply in relation to their nitrogen content. / In this respect the important tissues that particularly concern us are the bone marrow and the spinal cord. / Bubble formation in the bone marrow probably gives rise to "bends" while bubble formation in the spinal cord certainly is responsible for the paralysis of compressed-air illness. / These tissues with their high nitrogen capacities (table 1) are enclosed in bone thus preventing the free diffusion of nitrogen into contiguous tissues, and are consequently dependent for their nitrogen absorption or elimination on their blood supply which is relatively poor. / The concept that partial saturation at a high pressure is equivalent to complete saturation at a lower pressure is accordingly modified by excepting the spinal cord and the bone marrow. / Allowance will be made for the desaturation of these tissues by selecting from the nitrogen elimination curve the average percentage rate for the period of time corresponding to the duration of exposure to excess pressure. Thus, after a dive of 21 minutes duration, a rate of 3 percent per minute is selected as the rate of excess nitrogen elimination. It is observed that as the duration of exposure increases, the percentage rate selected for nitrogen elimination decreases—a decrease which is arbitrarily employed in order to prevent bubble formation in the spinal cord and bone marrow.

The following example will illustrate the method of calculating decompression time. Since the partial pressure of nitrogen is 79 percent of the gage pressure, no error will result if we speak in terms of gage pressure, and the calculations will be simplified.

Example: A diver is exposed to a pressure of 100 pounds gage for a period of 21 minutes.

(1) Percentage saturation of the body from figure 3 and table 6-----	45
(2) Air pressure in the lungs-----pounds--	100
(3) Average pressure in the body (0.45×100)-----pounds--	45
(4) With a difference in pressure of 15 pounds between the body and the lungs, decompression must relieve ($45-15$)-----pounds--	30
(5) With a constant difference in pressure of 15 pounds the pressure in the body will decrease at the rate (table 6) of (0.03×15) 0.45 pound per minute.	
(6) Time required for the second stage of decompression $\frac{(30)}{0.45}$ -----minutes--	67
(7) During the first stage in decompression the gage pressure is lowered over a period of 5 minutes to 30 pounds at a uniform rate.	
(8) During the second stage in decompression the pressure is lowered at the rate of 0.45 pound per minute from 30 to 0 pounds.	
Total time for decompression ($67+5$)-----minutes--	72

The data for calculating a decompression table applicable to men with nitrogen elimination curves similar to figure 3 are presented in table 6. In comparison with the standard table these computations will shorten the decompression time for short exposures, and will lengthen the early part of decompression after long exposures. The difference in the method of calculation between the proposed and the standard method for the first stage of decompression is shown graphically by figures 5 and 8. The advantage of the proposed method lies chiefly in the fact that a decompression table can be formulated for the individual or for a group of men of similar build on the basis of previously determined curves representing actual nitrogen elimination from the body. In the experimental diving unit in the Washington Navy Yard, it is possible to obtain a nitrogen elimination curve similar to figure 3 on every first-class diver, and to make quantitative measurements of nitrogen elimination in many of the diving tests. Such procedures should result in more rapid progress as a result of a better understanding of the physiologic principles underlying work in compressed air.

The interpretation placed upon the quantitative data in this paper should not be regarded as rigid or final, and any conclusions are subject to modification or revision as a result of diving tests. The data in table 6 may serve then as an outline for experimental diving work. That the standard table can be shortened with reference to decompression time for short exposures is indicated by the modification of the table as reported by Kagiya (1934) and by Hawkins, Shilling, and Hansen (1935). Whether the proposed method of decompression will prevent compressed-air illness after long exposures remains to be proved.

SUMMARY

The results of measurements of nitrogen elimination in man are presented, and their application to the problem of decompressing divers is discussed.

Although decompression governed by the standard procedure is safe for short exposures in compressed air, decompression after prolonged exposures (over 75 minutes) may be followed by compressed-air illness. In an analysis of this problem it was concluded that the practice of abruptly halving the absolute pressure and the comparatively rapid lowering of pressure in the early part of decompression might result in nitrogen bubble formation.

The retardation of nitrogen elimination from the body when bubbles are present in the blood was pointed out, and the danger of this condition while the pressure head of nitrogen in the tissues is high, was emphasized.

The proposed method of decompression is based on the use of a single curve which represents the rate and quantity of nitrogen eliminated from the body as a whole. To minimize the possibility of bubble formation in the early part of decompression the practice was suggested of maintaining a constant relative difference (i. e., air pressure of 12 to 19 pounds, nitrogen pressure of 10 to 15 pounds) between the pressure in the body and the pressure in the lungs.

The adoption of the proposed method of decompression in comparison with the standard procedure will shorten the time for short exposures in compressed air and lengthen the early stages of decompression after prolonged exposures to excess pressures.

The author wishes to express his thanks and appreciation to Profs. Cecil K. Drinker and Louis A. Shaw under whose direction this research was conducted. For technical assistance the writer is indebted to Miss Anne C. Messer, Mr. Robert M. Thomson, and to Mr. E. Preble Motley.

TABLE 1.—*The percentage of water and fat, and the nitrogen content of the whole body, the brain, the spinal cord, and the bone marrow of the dog*

	Percentage of fat	Percentage of water	Nitrogen content, cc per 100 g
Body as a whole.....	15.4	59	1.4
Brain.....	4.8	170	.94
Spinal cord.....	27.8	170	2.20
Bone marrow.....	190.0	-----	5.00

¹ Estimated.

TABLE 2.—*Relationship between the body weight, height, age, surface area, and the nitrogen content*

Subject	Weight (kilos)	Height (inches)	Age (years)	Surface area (square miles)	Total nitrogen (cc)	Cc per kilo
B. I. L.	62.3	69	28	1.75	¹ 786	12.6
M. U. R.	62.7	67	27	1.71	¹ 770	12.3
F. A. H.	67.7	67	33	1.77	¹ 1,002	14.8
B. U. R.	60.0	63	32	1.62	¹ 761	12.7
R. O. M.	56.4	63	30	1.57	¹ 776	13.8
T. H. O.	65.0	68	33	1.77	¹ 799	12.3
N. O. R.	76.4	71	22	1.95	¹ 1,426	18.7

¹ Nitrogen eliminated at the end of 6 hours. Oxygen percentage at the end of the experiment above 99. First minute of nitrogen elimination (rinsing period) calculated by multiplying the cardiac output by the solubility coefficient of nitrogen in blood.

² Nitrogen eliminated at the end of 4 hours. Oxygen percentage at the end of the experiment between 97 and 97.5. First 5 minutes of nitrogen elimination (rinsing period) calculated on the basis of subsequent experimental values.

TABLE 3.—*Nitrogen elimination during the breathing of pure oxygen at atmospheric pressure*

Minutes	B. I. L. (1 exposure)		M. U. R. (2 exposures)		F. A. H. (1 exposure)		Average percent of total	K
	Cc	Percent of total	Cc	Percent of total	Cc	Percent of total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5 ^{1 2}	155	19	173	22.4	239	24	22	0.04
11	264	34	236	30.6	—	—	32	.035
21	366	46.6	317	41.0	474	47	45	.030
31	442	56.0	376	49.0	548	55	53	.024
41	486	62.0	425	55.0	—	—	59	.021
61	552	70.0	501	65.0	673	67	67	.018
91	624	79.0	593	77.0	—	—	78	.017
121	671	85.4	656	85.0	845	85	85	.015
181	740	94.0	707	92.0	899	90	93	.019
241	743	94.5	753	98.0	996	99	97	.015
301	751	95.5	770	100.0	1,002	100	99	.014
361	786	—	765	—	998	—	—	—

Minutes	B. U. R. (7 exposures)		R. O. M. (8 exposures)		T. H. O. (6 exposures)		Average percent of total	K
	Cc	Percent of total ³	Cc	Percent of total ³	Cc	Percent of total ³		
(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
5 ^{1 2}	187	23	142	18	165	20	20	0.044
10	305	38	225	28	271	33	33	.040
15	374	47	284	36	349	43	42	.036
25	441	55	345	44	434	53	51	.028
45	529	66	435	55	559	68	63	.022
65	586	73	563	71	617	75	73	.020
85	606	76	609	77	662	81	78	.018
125	661	82	623	79	734	90	84	.014
185	697	87	705	89	774	95	90	.012
245	761	95	755	95	777	95	95	.012
540	—	—	—	—	—	99	—	.0085

¹ First minute calculated (42 cc).

² First 5 minutes calculated.

³ The assumption was made that the body as a whole was 95 percent desaturated at the end of 245 minutes.

TABLE 4.—The average of the nitrogen elimination values from 3 lean¹ but well-developed men who breathed oxygen at atmospheric pressure

Time	Experimental values	Calculated values		
		Fat N ₂	Water N ₂	Total N ₂
6 minutes.....	187	23	174	197
21 minutes.....	386	75	341	416
31 minutes.....	455	105	373	478
61 minutes.....	575	182	392	574
121 minutes.....	724	293	392	685
181 minutes.....	782	361	392	753
241 minutes.....	830	398	392	790
301 minutes.....	841	423	392	815
361 minutes.....	850	437	392	829

¹ Average weight 64 kilograms.

TABLE 5.—Compressed-air illness after decompression according to the standard tables¹ following prolonged exposure at 45 pounds gage pressure

Date	Exposure time (minutes)	Decompression time (minutes)	Symptoms
Feb. 13, 1933	223	122	3 hours after exposure, severe substernal irritation with deep inspiration, accompanied and aggravated by coughing. Pains in the extremities, fever, sweating, and malaise.
Feb. 28, 1933	150	122	20 minutes after exposure, intense pain in the left elbow, increased in severity and radiated between the shoulder and the hand. Fever, (1 chill), malaise.
Mar. 20, 1933	110	84	3 hours after exposure, substernal irritation, pain in the right knee and right hip.
May 15, 1933	120	84	Vigorous exercise during decompression. Immediately following decompression, pruritus and petechial rash over the chest. Fatigue particularly in the lower extremities.
May 24, 1933	90	84	Vigorous exercise during decompression. 1 hour following decompression pain in left elbow and knee. Pain in the chest on deep inspiration.
Oct. 23, 1933	120	84	Vigorous exercise at the beginning of decompression. 1 hour following decompression, deep-seated pain in the deltoid area (right arm) which radiated to the hand. Mild substernal discomfort.

¹ See Navy Diving Manual (1924), sec. X11, 3670.

TABLE 6.—Data for the calculation of a decompression table for men with nitrogen elimination curves similar to figure 3-A

Duration of exposure (1)	Percentage saturation of the body (2)	Percentage rate per minute of excess N ₂ absorbed or eliminated ($1 - e^{-k}$) ¹ (3)	Rate at which the gage pressure can be lowered to maintain a constant difference in air pressure between body and lungs of—		
			12 pounds (4)	15 pounds (5)	19 pounds (6)
21 minutes.....	45	3.0	Pounds per minute 0.36	Pounds per minute 0.45	Pounds per minute 0.57
31 minutes.....	53	2.4	.29	.36	.46
41 minutes.....	59	2.1	.25	.32	.40
61 minutes.....	67	1.8	.22	.27	.34
91 minutes.....	78	1.7	.20	.25	.32
121 minutes ²	85	1.5	.18	.22	.28

¹ For values of k (see table 3) less than 0.05, k and $(1 - e^{-k})$ may be considered equivalent.

² In excess of 2 hours the values for k in column 18, table 3, may be tentatively used. The minimum value for k can be taken as 0.0085 from the "fat" equation.

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AN ANALYSIS OF 18 SYPHILITIC REINFECTIONS

By J. A. MILLSPAUGH, Lieutenant, Medical Corps, United States Navy

Two hundred and fifty-eight health records in the syphilitic file at the dispensary, naval air station, Pensacola, Fla., were reviewed. Of these 18 were found to contain a distinct entry for reinfection with syphilis. The bulk of the data hereinafter to follow was derived from the now obsolete syphilitic abstracts, though each case was interviewed by the writer. For one reason or another many of these records were incomplete. Significant information was frequently not recorded. Confrontation of the patient elicited admissions in the nature of confessions that would probably not have been vouchsafed at a past more precarious time. Several patients firmly declared they had had official treatment not recorded; others were convinced the alleged reinfection was a relapse of the original infection. Pay, all important to the sailor, and time are lost because of the misconduct status imposed by venereal infection. Statements in rebuttal to syphilitic reinfection are frequent and oft absurd. Cases submitting statements in rebuttal are reviewed by competent authority and decision as to misconduct is decided by the Comptroller General. This observation is worthy of attention in deciding as to the accuracy of diagnosis in luetic reinfection. However, the records stand as

official, howsoever incomplete, and no deviation from recorded evidence was made in presenting this material.

A venereal patient is prone to prevaricate. Too much credence must not be placed upon the incubation period given in a history. Multiple or habitual illicit exposure may be denied if there is only one properly recorded recent prophylaxis. An alternative of summary court martial deters veracity.

As my senior medical officer has sagely remarked: "The value of a reported laboratory finding is in direct ratio to the experience and reliability of the technician." The organism of syphilis has been known for 30 years. Dark field differential morphology must be practiced to distinguish similar organisms, particularly spirocheta refringens, which is the most likely cause of error in genital lesions. The simplest, most accurate single diagnostic criteria of syphilitic infection is a positive dark field of a sterile normal saline diluted aspiration from the satellite bubo of a chancre. It is urged that this method be more widely adopted.

The chancre may be invisible, inconspicuous, unrecognized, overlooked, extragenital or concealed, and self-treated until healed. Mixed infection may complicate the clinical picture. Probably the majority of syphilitic secondary manifestations now encountered in the naval service are those that develop following an invisible primary lesion, such as an intraurethral chancre or those that develop following a concealed untreated or self-treated chancre.

It has been recently asserted that if a Kahn test were taken daily, positivity would be encountered at some time in every case of syphilis, despite treatment. Obviously this is an impractical measure. I wonder, too, how many positives we might detect in the nonluetic with such a daily procedure. In this connection it is pertinent that the Bureau of Medicine and Surgery disapprove establishing a diagnosis of syphilis by means of serological positivity alone. (See par. 2285, Manual of the Medical Department.) Many authenticated cases of syphilis remain seronegative if early and intensively treated.

All factors considered, it is at present generally conceded that neosalvarsan and bismuth are the two outstanding drugs used in the early treatment of syphilis. Mercury has been and is still widely used but with diminishing frequency. Potassium iodide is used but perhaps not necessarily, certainly not universally, in the treatment of early syphilis. In the summation of treatment administered the presented cases it would have been preferable to record treatment in exact quantities rather than as injections. This was possible in so few cases that for the sake of uniformity the latter term was necessarily chosen. Individual doses varied, when recorded, from 0.3 to 0.9 gram of neosalvarsan, the vast majority being 0.6 gram.

The latter dosage may be fairly used as an arbitrary average for those who wish to compute the quantity of treatment in grams. The average course of neosalvarsan consisted of eight injections. Why the number eight is so widely adopted as a standard course in the naval service I do not know. Most authorities recommend 10 or more injections to the course. MacDonald, in a study of 303 cases of syphilis, determined that an average of 14 injections of neosalvarsan are required to render a case serologically negative to the Kahn blood test. The average, indeed, nearly constant injection of bismuth given in a dose was 1 cubic centimeter, though as various preparations were used the bismuth content naturally varied. Bismuth salicylate suspension was most commonly used. A cubic centimeter of this preparation contains 0.13 gram of bismuth subsalicylate. Bismosal was the second most often used preparation of bismuth. Bismuth, too, was usually given in courses of eight doses. Mercury succinimide in one-fifth grain doses was the most frequently used injection of a form of mercury. For mercury inunctions the average amount used per dose was approximately 1 dram of ointment containing about 30 grains of mercury. The average course of inunctions included about 30 rubs. Neosalvarsan was the only drug used in every case. The average total treatment required to effect a cure of syphilis as evidenced by reinfection, according to this data, is 27.7 injections of neosalvarsan, 16.2 injections of bismuth, 10 injections and 31.1 inunctions of mercury.

A characteristic lymphadenopathy usually develops previous to dermal or mucous lesions and is thus one of the earliest signs of syphilis. General or polyadenopathy as tabulated is interpreted to include at least bilateral inguinal, epitrochlear, and posterior cervical lymphadenopathy. Involvement of the lymphatic system is truly a secondary lesion *a priori*. Lymphadenopathy is accorded a special distinction in tabulation only because secondary luetic manifestations as usually referred to include only skin and mucous membrane lesions. The question mark (?) indicates that lymphadenopathy was in all probability present but not specifically mentioned in the health record.

The total time elapsed in the intervals between injection was 61 years 88 months and 268 days or nearly 70 years, a mean interval being thus 3.833 years.

Prompt clinical response to the modern widely held dictum that syphilis should be early, continuously, and intensively treated has obviated some of the older criteria of syphilitic reinfection. At least in the naval service secondary luetic manifestations are increasingly infrequent, tertiaries rare. Dermal and oral lesions are not often encountered because the great majority of luetic infections are diagnosed in the primary stage, principally by means of the darkfield

6

7

8

I

28

20

Days

ions

1

9

- * Not in record.
- * Undergoing treatment.
- * To hospital, undergoing treatment.

In explanation of the chart; K—Blood Kahn test; 0—Negative; W—Wet but not mentioned in health record.

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examination. Treatment with neosalvarsan shortly follows. A blood **Kahn test** is almost invariably obtained.

There is an appreciable interval between treponemal invasion and positive serological finding. Treatment sufficient to prevent a positive serological development is often given during this interval as attested by a very considerable number of records.

The criteria of syphilitic reinfection varies. That accepted by naval medical officers as evidenced by the data presented is definitely less strict than that required by many authorities. However, in the last analysis the decision as to reinfection must be weighed for the individual case. Doubtless at least several of the cases here reviewed will not satisfy the conservative reader and for good reason. A searching inquiry of available literature reveals that in comparison both the number and percentage of syphilitic reinfections in the Navy is extraordinarily high. Several deductions may be drawn; among them that cure is earlier attained than is commonly conceded; reinfections in the naval service are more common by far than elsewhere; our people are either more frequently exposed to infection or they profit less by sad experience; the criteria of cure and reinfection employed in the naval service are inadequate.

The cases presented are arranged in alphabetical order as encountered in a file, numbers and rates are substituted for names. Thus, case no. 1 is a chief boatswains mate (permanent appointment) et cetera. It will be noted a majority of the predicated reinfections occurred among the younger personnel as indicated by their ratings.

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**PRINCIPLES UNDERLYING THE DIAGNOSIS AND TREATMENT OF
PSYCHIATRIC CASES**

By JAMES L. MCCARTNEY, Lieutenant Commander, Medical Corps, United States Naval Reserve

If we can believe statistics, mental illness is gradually becoming more prevalent, and more often than ever before the general practitioner has to deal with psychiatric problems. (1) This apparent increase, however, may be accounted for in various ways: within the past decade medical schools have been paying more attention to psychiatry and consequently physicians have come to recognize and understand psychiatric cases more easily. Coupled with this growing interest among members of the profession there has been a corresponding growth and sympathetic concern on the part of the public, with the result that mental illness has been losing many of its unpleasant associations. People now are not so likely to hesitate in consulting a physician about their emotional difficulties, and to seek treatment for themselves or relatives.

Unfortunately, however, there still are members of our profession and many persons in the community who think of psychiatric disorders in terms of "insanity", and who consider the psychiatrist as some peculiar individual who has occult powers that make him "queer." They seem to be satisfied when the patient is duly examined and committed by the court. Thus they feel that "the family skeleton" has been safely "locked away in the closet" and thereafter to be only mentioned in hushed voices. If the patient should recover and return home he henceforth lives under a veil of apprehension. His family and friends lack confidence in him; the neighbors feel sorry for him and continue to offer the alibi that there must have been "a bad streak in the family somewhere." If the patient's symptoms are not so marked and he cooperates to a certain extent with the physician, then the situation is discussed in terms of "nervousness" and the physician may blindly undertake the treatment, trusting to luck that the patient will recover from the "nervous breakdown." It is explained to the patient that he is "run down" and needs a tonic, or if he is troubled with insomnia he is empirically given a sedative. He is then patted on the back and told that there is nothing the matter with him, and it would be wise for him to take a trip or go to the country for a few weeks. Sometimes categorically a somatic disorder is diagnosed and treatment is given accordingly. If the physician does not wish to be bothered with this troublesome case he is likely to look upon the patient as a hypochondriac, and by referring the patient to get him off his hands the patient stands a good chance of becoming a chronic invalid, and is apt to drift away from qualified physicians to become the support of some quack or cult. The fact is that these cases sometimes work out a fairly satisfactory adjustment

in some religious, dietary, physical culture or nature cure, which puts a shame to our profession.

In the past the tendency in psychiatric fields has been to classify or diagnose the patient and to progress no further, allowing the person to work out his own salvation, but, as said before, in recent years physicians have been paying more attention to the human emotions. They have become aware of the fact that the total personality must be considered if the patient is to be scientifically treated. To just diagnose the case is not sufficient, but the object should be to eliminate the underlying trouble and to attempt to bring about a satisfactory adjustment of the total personality. We cannot put the blame on heredity nor on environment, but must consider both these factors in our thorough search for the causes and cures of abnormalities.

Heredity may be something to speculate about, but the environment is something that can be studied, and it can be determined whether it is a definite departure from an accepted standard in the community or whether it is entirely normal. The environment at times only aggravates family heredity; but at other times environment alone produces the abnormal state. It is essential, therefore, in the diagnosis of psychiatric cases to carefully study the social background of the patient and his family.

There has been a tendency in some circles to shift responsibility by explaining psychiatric disorders on an entirely constitutional basis and to blame heredity for mental upset. There is much that is highly suggestive in the study of heredity, but not so much that is positive except that psychiatric disorders do recur in certain families. But whatever the situation may be in regard to heredity, it must not be allowed to influence the physician unduly in his endeavor to treat the patient. Otherwise, the outlook is rather hopeless. This is just as true in dealing with psychiatric cases as it is in dealing with a family history of cancer or tuberculosis.

Although it is necessary to understand the patient's personality as a whole, the wide use of the expressions "personality" and "the reactions of the individual as a whole" makes it imperative that these terms be used advisedly in order to avoid loose thinking and snap judgment. When the term "neurosis" is qualified by such adjectives as "gastric", "cardiac", "sexual", etc., there is a suspicion that the "physical", "mental", or "emotional" factors are being differentiated instead of the problem being looked upon as a total reaction of the individual. For example, in one case that came under observation there was a wide range of diagnoses possible. The patient at various times, following what appeared to be adequate causes, developed different syndromes: spasticity of the extremities and coarse tremors; flatulence, heartburn, and epigastric pain; anxiety, rapid pulse, rapid and difficult breathing with extreme paleness and giddi-

ness; and periods of marked emotional depression when none of the previous symptoms were in evidence. It is obvious that the early symptoms may have been easily diagnosed erroneously. All facts recorded in past clinical histories and examinations should therefore always be kept clearly in mind, and obviously unrelated data should not be forced together in order to arrive at some formal diagnosis. Enthusiasms should not be mistaken for clinical data. Emphasis should be put on the understanding of the symptoms in relation to the development and experiences of the patient.

Constitutional traits, experiences, and resulting tendencies are often referred to as the personality make-up. It is clear that the personality make-up is not static, but potential and dynamic, and that it is in a constant state of evolution. It must be remembered that the individual is sensitive to both internal and external stimulations, and is being continually modified in one direction or another as the result of the person's experiences, and through it all a certain life plan frequently can be discerned. This is so, even when superficially there appears to be marked and radical deviations.

Mental activity is made up not only of ideas or concepts but also of their accompanying effects or feeling tones. The effect may become detached from its original concept and become attached to an altogether different concept. It is not the object of this paper to discuss mental mechanisms, and no doubt you are all aware of the fact that when any part of the repressed material and its effect break through the repression into consciousness their genesis is not recognized and therefore they appear in a highly disguised form which is never recognized by the patient and many times is overlooked by the examining physician. It is therefore most important that in the study of every psychiatric case that a full history be obtained, and that the essential facts concerning the constitutional make-up and the life history be studied and evaluated as well as the data concerning the immediate condition which brings the patient to the physician. A cross section should be made of the personality make-up and the soma at this point. When all of the immediate facts have been obtained a complete history or longitudinal survey should be obtained. Cross sections should then be made at such levels as appear to give opportunity to study the processes of the individual's development. The data should then be put together and evaluated; and if the study has been reasonably successful a good understanding of the predisposing and precipitating causes of the illness will be evident. Only when this understanding has been reached will an adequate treatment outline be possible.

The study of the past history of the patient and his personality make-up is of course time consuming, and this is no doubt the main reason why the general practitioner does not wish to be bothered with

psychiatric problems. However, if the physician will take the time to study these cases he undoubtedly will be rewarded by the results he obtains.

After the family history has been taken inquiry should be made as to the condition of the mother during her pregnancy and labor at the patient's birth. This should be followed with questions about the physical status of the infant during the first year of life; the feeding and weaning problems; the age of walking and talking; the child's reaction to training in control of the bowel and bladder; the disposition, whether happy or tearful; and occurrence of tantrums, fears, and night terrors. Many of these points give significant insight into the later psychiatric disorder.

Inquiry should also be directed toward the patient's intellectual growth and social development, and special attention should be directed toward the sex manifestations, both psychological and physical. At this point it is well to get a picture of the family, the family life and atmosphere, and the relations of each member of the family to the patient and the patient's attitude toward the members of his family. Many of the habits of thinking and reacting are acquired by example and training and have a great bearing on the development of the personality.

A complete history of all injuries and physical illnesses should be taken, including exposure to toxic influences, the use of alcohol and drugs, including medication. The patient's attitude toward them should be ascertained also. This was brought out quite vividly in a recent case which came to our observation here at the sanitarium when a woman was given considerable physical attention toward the diagnosis of an evidently paralyzed arm. Unfortunately, no thorough history had been taken of the case, but the conclusion was finally reached that there was no organic basis for the paralysis and the patient was referred for psychiatric opinion. When the history was gone into it was evident that the woman's emotional instability, which had centered upon her left arm and shoulder, was the result of an addiction to phenobarbital, coupled with an intense family situation. (2)

It is important to know something of the patient's output of energy as shown by his ability to apply himself to recreation and work; to learn his feelings about his inner self, and about other people; his attitude toward his environment and community life and responsibilities; practicability of his ideas, about the realities of life; and his interest in abstract and mystical subjects and superstitions; the range and quality of his emotional reactions, and his general feeling of adequacy or inadequacy toward his life responsibilities. It is, of course, important to determine exactly how the patient reacted in certain situations, such as love affairs, marriages in the family, and

death. The occurrence and nature of any previous attacks should be ascertained.

It is necessary in the study of the present illness to get a good account of the patient's complaint and the patient's opinion as to why it developed. Early in a disorder most of the precipitating factors will be found in the account as given by the patient, but as time goes on exact details fade out and more remote matters and rationalization take their place. The mental trends and the account of the psychological moment of onset often give a direct clue to the whole situation and the mechanism of the emotional upset. It is thus evident that the earlier the physician sees a case and the more complete the account of the onset obtained, the better the case is understood and so the more surety of helping the patient.

A careful inquiry should be made as to the presence of any acute somatic disorder, but if there is one, restraint must be exercised in ascribing undue importance to it in the presence of psychological symptoms. There is no question that somatic illness may cause psychiatric disorders, that it may materially influence the course of the psychiatric disorder, that it may itself be obscured by psychiatric symptoms, or that the two may be concomitant without materially influencing the course of either. Physiological changes (3) are common in acute psychiatric disorders. In elated states there may be vasomotor disturbances, increased basal metabolism, and increased sugar metabolism. In depressed and apathetic states there (4) frequently is a retardation of these functions. These findings may lead the physician astray in his diagnosis if he is not very careful to weigh all the factors found.

Of course physical disorders sometimes impair the psychological defense mechanisms and act as a release to personality disorders which then dominate the clinical picture. These symptoms often disappear when the physical disorder has been corrected. Somatic conditions may also act as precipitating factors or means through which the personality can express itself in terms of psychopathology. This is commonly seen in the psychiatric disorders that not infrequently accompany pregnancy, childbirth, or the postpartum.

There are the typical organic mental reactions which are directly dependent upon somatic disorders. These are generally found in toxic and exhaustive states or degenerative disorders such as alcoholism, paresis, senility, arteriosclerosis, and other diseases which cause changes in brain tissue. Delirium, confusions, defective orientation, hallucinations, paranoid trends, and Korsakow-like syndromes are psychological symptoms typical of these reactions.

On the other hand, there are many hysterical states that present typical somatic symptoms. Cases of hyperthyroidism precipitated by emotional causes are not uncommon. You are all familiar with

the vasomotor and gastrointestinal phenomena occurring in fright, worry, and embarrassment. Cases of spurious pregnancy with the accompanying distension of the abdomen and enlargement of the breasts in women fearing or longing for pregnancy and cases of morning vomiting in the same situation are quite common.

The psychiatric patient and his relatives are very anxious to be assured that the physician can do something to straighten out his difficulties, and although it is essential to give reassurance it is especially necessary not to overestimate the ability to solve the problem. As Osler says in the last edition of his textbook, *The Principles and Practice of Medicine*, the treatment of these cases "presents a varied problem to the thoughtful physician. Every case must be handled upon its own merits, no two, as a rule, requiring exactly the same methods." Osler is certainly correct when he goes on to say that "Treatment by drugs should be avoided as much as possible. Hydrotherapy is indicated in nearly every case if it can be properly applied. Hypnotism is rarely indicated. Carefully practiced suggestion and psychoanalysis is of value. The use of religious ideas and practices may be most helpful." These precepts were written about 20 years ago, but they are essentially true today although psychiatry and psychotherapy have made their greatest advances since the World War. (5)

It goes without saying that no matter what the psychogenic factors may be in a given case, if somatic defect is demonstratable, these physical factors should receive attention at the same time that any other part of the treatment program is instituted. For example, all foci of infection and sources of toxemia should be corrected without delay.

Many times when the psychiatric case comes to the attention of a psychiatrist the patient is suffering from the toxic effects of drugs. In this condition the individual is not only suffering from the deleterious effects of the resultant toxemia, but the essential symptoms of the disease from which he is suffering may be hopelessly clouded. Nevertheless drugs may have to be used for a time, such as when beginning treatment of insomnia. Nevertheless, even in this case a very careful selection of hypnotics should be made to be sure that they are properly fitted to the individual, and care should be taken to interrupt the administration of the drug from time to time to see if normal sleep will supervene. Also it is necessary to change from one hypnotic to another in order to prevent cumulative effects or addiction. In any case it should be understood that hypnotics should be resorted to only when other means have failed. (6)

One of the most annoying symptoms met with in psychiatric cases, especially among depressed individuals, is refusal of food. Nourishment is essential to health and life, and if the patient refuses to eat

a balanced diet, he should be spoon-fed. If this fails, and he is obviously in need of nourishment, the physician should institute tube-feeding without delay. This method may be employed either by the nasal or the esophageal route. Fortunately if this method is explained to the patient and preparations made for the tube-feeding in his presence, the patient may thus be persuaded to resume his normal eating habits.

The various forms of hydrotherapeutic devices constitute one of the more valuable means of treating psychiatric cases. This is especially true in the treatment of excited cases. Where hydrotherapy is not available these have to be handled by manual, mechanical, or chemical restraint. All of these means are undesirable if avoidable. This is no place to discuss the various types of hydrotherapy, but they vary from the continuous bath, which requires elaborate equipment, to the warm bath of a few minutes' duration, or the wet pack which may be easily applied in the home. When skillfully applied, this latter method has a marked sedative effect and usually induces sleep.

It is inevitable that in the administration of packs and baths errors will be made which contribute to unfavorable reactions, but in general the results are usually surprisingly satisfactory. When the patient is snugly confined in a pack there is a reduction in the stimuli which arise in voluntary muscular activity. Every time a muscle contracts or a part of the body moves, there is a series of centripetal nervous impulses, and the restraint of the pack therefore tends to decrease cerebral activity. As a rule the results are better if the treatments are given in a soundproof and darkened room. The patient should be given the treatment in a room by himself, and after release from the pack he should not be subjected to external stimuli. As the patient's condition improves he may be hardened by stimulating showers, but whatever the kind or the stage of the illness may be, packs or baths should not be prescribed indiscriminately nor in a routine manner. Whatever the treatment used the patient should be given frequent explanations about the method used and his full cooperation gained if at all possible. (7)

It is impossible at this time to fully discuss the subject of psychotherapy, and the literature on the subject in recent years has become very extensive and needlessly complicated. The main thing to remember is that in mental and emotional disorders that are psychogenic, something may be expected from a direct appeal to the mental conditions as a result of which the symptoms developed, and by an honest review of the factors on which the personality is constructed to lead the patient into true insight.

The conception appears to be general that psychotherapy is summed up and included in suggestion, and that all the physician needs to do

to correct a psychiatric disorder is to explain to the patient the mechanism of the disorder. Aside from the fact that no one seems to have a very clear idea of just what suggestion really is, this conception ignores the recent work that has been done along these lines. Suggestion really plays on the surface. The fundamental, underlying conditions are not reached by suggestion. The underlying conditions which produce the symptomatology are often the same conditions that make suggestion possible. The accepted suggestion may be quite as much a pathological product as the various symptoms themselves.

Suggestion may be used to benefit in some cases to tide the patient over a crisis, and in order to establish confidence, but the essential object of psychotherapy is to take the disordered material which the patient has brought to the physician, to sort it over, rearrange, add to, and build it into a new and enduring structure.

This reeducation of the patient is dependent more upon the attitude of the physician than upon any particular thing he may say. He should be without criticism and always understanding.

Finally, in the treatment of all psychiatric cases, occupational therapy is a valuable adjunct. Most people have too much leisure time, and when the mind has nothing with which to constructively occupy itself, the mind gets into mischief and does a lot of damage to the personality. Some useful and consuming occupation should be found for every case as it serves to divert the attention and interest from the disintegrating indulgence of phantasy.

Everyone, the world over, rationalizes his lack of knowledge and understanding, his mistakes and successes, his inadequacies and potentialities. And so, both the patient and the physician constantly tend to rationalize the patient's symptoms and state of health. The psychic mechanism is something against which every physician must be on his guard. He should not accept too readily the nearest explanation, the most plausible reason or the conventional one. Hard work and over-study do not bring about a "nervous breakdown" unless there are conflicts connected with them in some way. Worry is always associated with insecurity because it denotes a lack of understanding or a feeling of inadequacy in meeting problems.

The regaining of mental health necessitates an adequate level of integration of the whole biological unit, which is interpreted as personality. Anything, psychological or somatic, internal or external, which interferes with the integration impairs the adjustment the individual must make to life and reality. The type and degree of the impaired adjustment will depend upon the quality of the integration of the personality makeup in its largest sense, the psychological value of the precipitating cause, whether it be psychic or organic,

and the mechanisms present in the reaction. These can be known and understood only through a careful mental and physical examination.

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CLINICAL NOTES

REPORT OF A CASE OF ADENOCARCINOMA OF CAECUM WITH RAPID METASTASIS

By THOMAS G. HAYS, Lieutenant, Junior grade, Medical Corps, United States Navy

CASE REPORT

M. C. age 31, Filipino, officer's cook second class, United States Navy, was admitted to the United States Naval Hospital, San Diego, Calif., on September 27, 1932.

Complaints on admission.—(1) Severe cramps in right lower quadrant; (2) Chronic constipation; (3) Anorexia and loss of 25 pounds weight over a period of a few months; (4) Nocturia 4 times, and polyuria.

Family history.—Negative so far as obtainable.

Past history.—Muscular rheumatism, burn on face, tonsillitis acute, and constipation.

Onset and course of present illness.—The patient states he has been constipated for several years, but otherwise was in good health prior to March 1932. At this time there was a gradual onset of soreness in his right lower quadrant and tenderness to pressure over this region. Constipation was present, but no vomiting at this time. He was placed on a liquid diet and in 2 days the soreness subsided. There was an interval from March 1932 to August 1932 during which he states he was free from symptoms, except for constipation and gradually increasing sense of fullness in right side of his abdomen. On August 13, 1932, he reported to the sick bay complaining of severe cramp-like pains in the right lower quadrant, which were severe enough to keep him awake at night. On September 27, 1932, he was transferred to the United States Naval Hospital, San Diego, Calif.

Physical examination.—The patient is fairly well developed, poorly nourished, and rather acutely ill.

Blood pressure: Systolic 90, diastolic 45.

Lungs: Inconstant crepitant râles over both bases.

Abdomen: Markedly distended and liver down two fingers below costal margin. Tenderness on pressure over McBurney's point, where a mass about the size of a lemon is palpable. The mass is hard and fairly well fixed. There is splinting of both recti muscles.

Reflexes: Very brisk.

Rectal examination.—On digital examination: A firm, fixed mass about the size of a walnut was found to the right of the prostate. This mass apparently does not involve the prostate and is quite tender to pressure. The proctoscope could only be passed for a distance of 3 inches before it met an obstruction, but two polypi were seen in the portion visualized.

Cystoscopic examination.—The bladder capacity was 350 cc, and the posterior wall of the bladder was pushed forward by an extracystic mass. The pyelogram showed the right kidney displaced downward by an enlarged liver.

X-ray chest: Negative for metastasis.

Barium enema: The liver is definitely enlarged. The clyster entered slowly, and the rectal ampulla compressed to less than one-third average size. The sigmoid colon filled very slowly and was displaced posteriorly and to the right. The hepatic flexure and ascending colon displaced downward by an enlarged liver. The terminal ileum was displaced upward and lies horizontally, evidently due to an abdominal mass occupying the right iliac fossa.

Operation.—On October 6, 1932, 9 days after admission, an exploratory operation was performed, with the view in mind of relieving the intestinal obstruction. A large tumor was found involving the caecum. Excision of caecum, terminal ileum, and part of ascending colon was done and an end to end anastomosis of the ileum to the ascending colon was performed. A fixed tumor mass was found in the right pelvis, but this was not molested.

Course.—The patient made a nice recovery from the operation and had no further constipation or vomiting. On October 28, 1932, he was up and about and fairly comfortable. Two weeks later, a small tumor was felt in the skin at the lower end of the operative wound. This mass gradually increased in size, the liver rapidly enlarged, and the patient complained of severe pain over the liver. It became necessary to keep him under the influence of opiates continuously. By February 27, 1932, 5 months after admission, his condition was critical. He was greatly emaciated, and his liver extended down to the level of the umbilicus. Edema of feet and ankles developed and a marked respiratory stridor. On March 1, 1933, the patient expired.

Laboratory report on excised tumor.—The gross specimen consists of the ileocecal junction with 6 inches of the ileum and lower end of caecum. On section the wall of the caecum is seen to be diffusely thickened with a nodular excrescence on the side. There is a large gland (2 cm) lying in the mesentery. The gross appearance of the lesion suggests carcinoma. The microscopical examination of the sections of the tumor in the caecum as well as the mesenteric gland, shows an adenocarcinoma. Nucleoli are prominent. Hyperchromatic nuclei are the rule and mitotic activity is marked. The tumor appears to be one with a high degree of malignancy. The pathological diagnosis is adenocarcinoma of the caecum.

Laboratory findings.—Blood count, urine, feces, and sputum essentially negative.

Autopsy report.—The body is that of a Filipino male, moderate stature, greatly emaciated. There is a scar of a low right rectus incision present. The body has been embalmed.

Chest: The pleural cavities are much encroached upon by the highly arched diaphragm. There is a moderate excess of pleural fluid. The left lung is bound down by firm fibrous adhesions. On section both lungs show edema, and the middle lobe of the right is completely collapsed.

Heart: Negative.

Abdomen: There is about a liter of clear straw-colored fluid present in the peritoneal cavity.

Liver: Tremendous in size, weight 5,570 gms, and is filled with large masses of yellowish-white tumor tissue, the centers of which are necrotic. There are tumor implantations in the lower end of the surgical incision mentioned, on the surface of the ileum, in the omentum where the tumor lies as a freely movable mass, and in the pelvis, filling the space between the bladder and the sigmoid. The mesenteric glands show large masses of tumor tissue. The ileocolic anastomosis shows no tumor tissue and is in good functional condition.

Kidneys: Show a cloudy swelling.

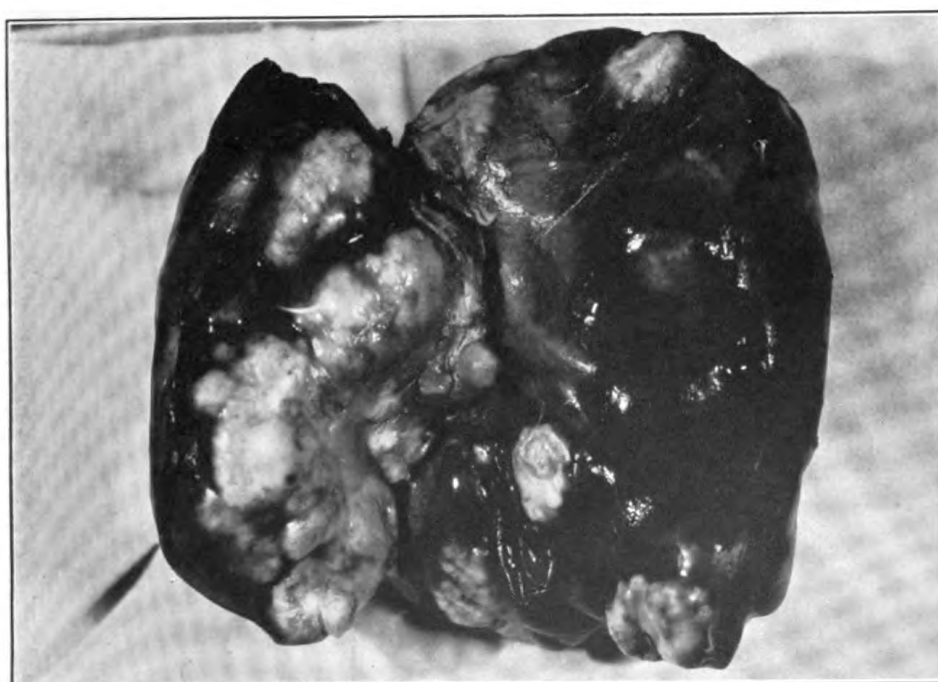
Spleen; adrenals: Negative.

Pancreas: There is tumor tissue present out side of the capsule of the pancreas, but it has not invaded the pancreatic substance.

Prostate: Normal in size.

Pathological diagnosis.—

1. Metastatic carcinoma (origin—caecum) in liver, lymph nodes, and peritoneum.
2. Pulmonary edema.
3. Cachexia.



AUTOPSY SPECIMEN OF LIVER.

CHIEF POINTS OF INTEREST

1. The comparative youth of the patient, his age being 31 years.
2. The extreme malignancy of the tumor.
3. The value of operative treatment in such a case, saving much pain and preventing the necessity of an ileostomy.
4. The success of removing all tumor tissue undertaken at the operation, as the autopsy report shows the ileocolic anastomosis free from tumor tissue and in good functional condition.

REPORT OF A CASE OF FATAL POISONING FROM SODIUM FLUORIDE

By M. R. WIRTHLIN, Lieutenant, Medical Corps, United States Navy

This case is reported because of the general use of sodium fluoride as an insecticide and its rarity as a suicidal vehicle with fatality.

History.—Miss M. B., aged 17, was seen about one-half hour after she had ingested approximately one-half a pound of sodium fluoride, dissolved in water. Miss B. was found by her sister, to whom she admitted taking this poison and the amount, with suicidal intent, at 11:20 p. m. At this time the patient complained of epigastric pain, nausea, vomiting, diarrhea, and dyspnea.

Examination.—The patient was semiconscious but could be aroused with some difficulty. Her face was pale and covered with cool perspiration. The conjunctiva was congested and the lips slightly swollen. The mucous membranes of the nose and throat were swollen and congested. Respiration was labored and deep. All cardiac sounds were normal. The pulse was full, regular but rapid (120 per minute). The abdomen was acutely tender and some muscle guarding existed in the epigastrium. Deep palpation over the upper abdomen aggravated the nausea to retching and vomiting. The vomitus was clear except for few streaks of blood and some mucous. The extremities were limp and slightly cyanotic. During the examination and treatment the patient had several watery, bloody stools.

Treatment and subsequent course.—Copious and repeated gastric lavage with lime water and 10 percent calcium chloride solution, followed up with 10 cubic centimeters of a 1-percent solution of calcium chloride intravenously was given within an hour after the ingestion of the poisoning. One cubic centimeter of digifolin and one-thirtieth grain of strychnine was given hypodermically. At 12:40 a. m., cyanosis deepened and respiration ceased. Artificial respiration by the Schaffer method was instituted. The heart continued to beat regular until 1:54 a. m., at which time no cardiac sounds were perceptible and the patient was pronounced dead at 1:55 a. m.

Detection.—Chemical analysis of the original vomitus and of the contents of the package from which the poison was taken were positive for sodium fluoride.

Comments.—If the patient's statement can be relied upon as to the hour of ingestion of the poison, approximately 2½ hours existed between ingestion and death.

One book on toxicology states that no human fatalities from sodium fluoride have been reported. The dispensatory states that it is certainly toxic and that McNally (J. A. M. A., 1923, lxxxi, 811) reported four cases of fatal poisoning by sodium fluoride, and lists the fatal

doses for man as between 5 and 10 grams. Unfortunately, no necropsy was performed in this case. Rigor mortis did not set in until 4 hours after death.

RENAL DYSTOPIA

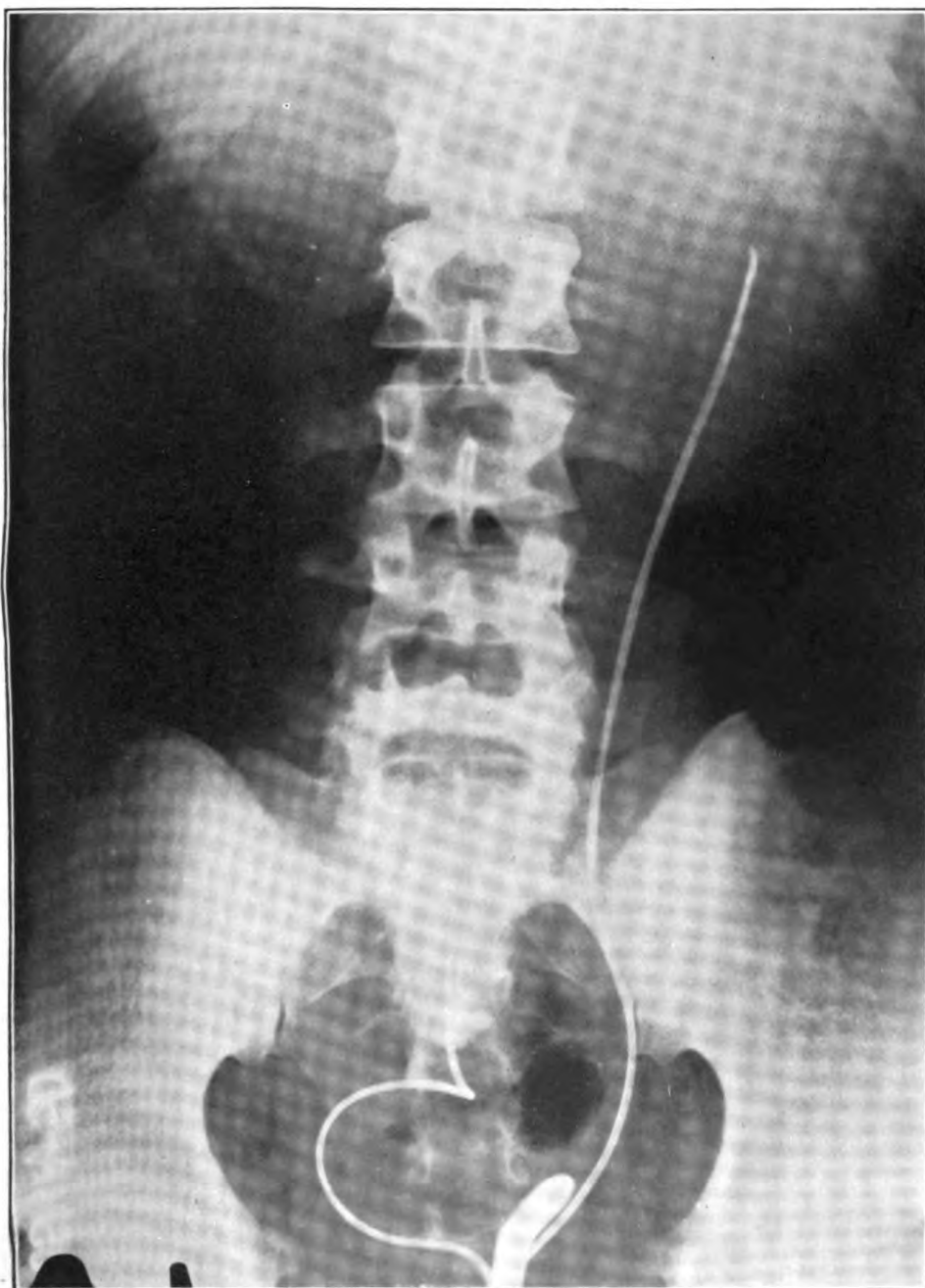
By J. F. LUTEN, Lieutenant, Medical Corps United States Navy

In recent years voluminous literature has appeared dealing with anomalies of position, the so-called renal ectopias or renal dystopias as one may choose to call them. Interest in this subject has largely been maintained due to their important surgical aspects. Surprisingly few of these anomalies are diagnosed during life but a relatively large number are discovered on the autopsy table. This leads us to believe these anomalies are not so rare as formerly supposed but occur with surprising regularity in a certain percent of patients. However, it is not difficult to explain why comparatively few of these cases are diagnosed during life, when one considers that many of them are asymptomatic. Others present vague, indefinite abdominal symptoms which are not referable to the urological tract. Many symptoms are caused by pressure or contact with other abdominal organs, blood vessels, nerves, or viscera, and are often misleading. How many cases with complex and baffling diagnostic problems have we experienced which might have been explained by a renal dystopia if the urinary tract had been thoroughly investigated after other means had failed to reveal the underlying pathology? With the introduction of intravenous pyelography and its gradual, more extensive use in general practice, many elusive and phantom subjective abdominal symptoms may be explained by a renal ectopia.

It is not the purpose of this paper to present a lengthy discussion on renal dystopias which have been so ably discussed from time to time in medical literature. However, recently, on the urological service at the United States Naval Hospital, San Diego, Calif., a case presented itself which amply illustrates many of the points mentioned in the preliminary discussion and warrants reporting.

C. O. W., Sea. 1c., unmarried, white, male, age 27 years, was admitted 11 June 1935, with a diagnosis of chronic prostatitis. His chief complaint on admission was dull, nonradiating pains of equal intensity in the upper lumbar region and occasionally in the left lower abdominal quadrant. The pains were intermittent in character and occurred paroxysmally. There was also occasional dull, nonradiating pain in the right lower abdominal quadrant. These symptoms were accompanied by slight burning on urination and a nocturia of two times. There were no chills, fever, hematuria, or pyuria. The patient felt physically below par, tired easily on exertion, and had occasional dull headaches.

These symptoms had persisted almost constantly with short periods of remissions as long as he could remember. According to the patient's own statement his father has taken him to many doctors and spent much money in an effort to find the cause of his complaints, without relief.



CASE 1.—PLAIN K. U. B. WITH CATHETERS IN PLACE SHOWS CALCULUS LYING OVER SACRUM WITH LEFT KIDNEY IN PELVIS.



CASE 2.—PYELOGRAM SHOWING LARGE HYDRONEPHROSIS AND HYDROURETER.

He completed one enlistment of 4 years in the Navy and was on the sick list many times. He has served approximately 14 months on his current enlistment, with several admissions to the sick list before transfer to this hospital. Previous examination on one occasion included cystoscopic instrumentation without ureteral catheterization, as a normal bladder was reported.

The roentgenologist at that time had previously reported "an irregular opaque shadow lying in the midline over the third sacral segment, probably a foreign body in the sigmoid." No intravenous pyelograms were taken or further urological investigation carried out, and the patient was discharged from treatment with little improvement. The family history was irrelevant, and the patient denied venereal infection.

The patient considered his case hopeless and incurable and after his previous experiences at first refused to submit to investigation. His chief desire was to be discharged from the Navy. Finally, with reluctance, he agreed to examination.

Physical examination revealed an intelligent white male apparently about 27 years of age, weighing 155 pounds, 68½ inches tall, well nourished and well developed. There was a carious, first upper left molar. Tonsils were absent. There were no palpable abdominal masses, no costovertebral tenderness, and no tenderness to Murphy's percussion. The kidneys could not be palpated. B. P. 120/70. Prostate normal. Secretion normal. Examination otherwise negative.

Urinalysis showed albumin 1 plus and numerous leucocytes Kahn negative. Urea nitrogen 14. Pthalein first hour 75 percent, second hour 23 percent. R. B. C. 4,740,000. Hemoglobin 90 percent. W. B. C. 9,000. Band forms 4; segmented 58; lymphocytes 30; eosinophiles 2; basophiles 0; monocytes 6.

Plain K. U. B. revealed a slightly irregular shadow, 1.6 centimeters Xl, 2 centimeters lying over the third sacral segment and in the midline.

The outline of the right kidney appeared normal in size, shape, and position. The kidney outline cannot be distinguished on the left as it was obliterated by air shadows in the intestinal tract.

Cystoscopic examination revealed a normal bladder. The ureteral orifices were normal in size, shape, and position. A number 6 catheter passed easily to the pelvis on the right. Urine flow normal. Color clear. A number 6 catheter passed 20 centimeters on the left, where definite impassable obstruction was encountered. The urine flow was slower than normal and blood-tinged. The bladder and left kidney cultures showed B. Coli. Pthalein given intravenously showed an appearance time of 2½ minutes on the right with 25 percent elimination of dye in 15 minutes. The appearance time on the left was 4 minutes and 15 percent of dye was excreted in 15 minutes.

K. U. B. with catheters in place revealed the right catheter well up in the kidney pelvis. The kidney appeared normal in size, shape, and position. The ureter pursued a normal course.

The left catheter lies approximately in the midline of the sacrum and the tip can be seen at the level of the first sacral segment. The opaque shadow previously reported in the other K. U. B. is lying beneath the catheter over the third sacral segment (fig. 1). The right pyelogram and ureterogram were negative. The left pyelogram reveals a small sausage-shaped mass lying over the sacrum and approximately in the midline which represents a kidney pelvis. Rudimentary calyces can be distinguished extending to the left (fig. 2). A short ureter can be seen.

The cystoscopic findings were confirmed by intravenous pyelograms (Neolopax, fig. 3).

A definite diagnosis of ectopic left kidney, pelvic in type, with calculus, was made.

Nephrectomy was decided upon. Spinal anaesthesia, novocaine 120 milligrams, was given. The approach was through a low midline abdominal incision extending from the pubic symphysis to the umbilicus and transperitoneally. The incision gave excellent exposure and the kidney was delivered easily and removed after the pedicle and the blood supply which came from two sources, the aorta and the left iliac, were ligated. The abdomen was closed without drainage and convalescence was uneventful. The patient returned to duty, symptom free, after 94 days on the sick list. Patient seen 5 months later, in good health.

Biopsy report of kidney:

Gross inspection.—A small kidney weighing 90 grams. It measures 9 centimeters in length, 6 centimeters in width, and 3.5 centimeters in thickness. When sectioned, a mulberry calculus is obtained, measuring 1.6 centimeters by 1.2 centimeters. It is firmly embedded in the superior calyx and protrudes into the pelvis. The cortex of the kidney is thinner than normal (fig. 4).

The proximal portion of the ureter measuring 16 centimeters in length is attached to the organ. Its walls are thickened and patent throughout.

Microscopic examination.—There is a reduction of the total number of glomerulae, many being completely obliterated. The capsules of the other glomerulae are thickened and undergoing fibrosis. Many of the proximal convoluted tubules are dilated. Several areas of calcification, varying in extent, are present and are scattered throughout the kidney substance. The ureter walls are uniformly thickened. Many of the arteries and veins in the walls are thickened and contain polymorphonuclear leucocytes, few small round cells and plasma cells.

Histopathological diagnosis.—Atrophic kidney with pyelonephritis, ureteritis, and calculus.

Plate 5: Intravenous pyelogram taken in another case. A retrograde had not been taken since a catheter could not be passed on the left side, a seemingly impossible obstruction being encountered at the uretero-vesicular junction. Plates taken at different time intervals showed the same persistent shadow just above the bladder at the brim of the pelvis. On the basis of the intravenous pictures alone a tentative diagnosis of ectopic kidney was made.

Left retrograde pyelogram of the same case several weeks later after a catheter had been passed following persistent and repeated attempts. An enormous hydronephrosis and hydroureter containing approximately 1,000 cubic centimeters fluid is shown. Patient's age was 42 years with 17 years active service in the United States Navy. Chief complaint on admission was occasional backache, intermittent burning over bladder when full, and intermittent hematuria of 15 years' duration. No previous diagnosis established. Left nephroureterectomy was done and patient restored to active duty in excellent health. Patient seen 1 year later and in good health.

SUMMARY

1. Renal dystopias are more common than formerly supposed and interest is largely maintained due to their important surgical aspects.

2. Intravenous pyelography is an important adjunct to urology and other branches of medicine as well. With its more extensive use many elusive abdominal symptoms may be explained by renal dystopias.

3. Diagnosis should not be established on the findings of intravenous pyelograms alone. When feasible, retrograde pictures should be taken to confirm the intravenous findings or vice versa.

4. Nephrectomy was decided upon rather than nephrolitomy as previous cases reported in literature invariably result in a second operation with removal of the kidney. Biopsy findings substantiated this choice of treatment in the case reported.



CASE 1.—INCISED KIDNEY SPECIMEN SHOWING STONE IN SUPERIOR COLYX.

NAVAL RESERVE

MEDICAL CORPS

PROMOTIONS, UNITED STATES NAVAL RESERVE, FOURTH QUARTER, 1936

Lt. Comdr., Henry V. Wildman, M. C.-F, promoted from lieutenant M. C.-F, December 3, 1936.

Lt. Sam C. Bostic, M. C.-F, promoted from lieutenant (junior grade), M. C.-F, December 4, 1936.

Lt. Herman D. Scarney, M. C.-F, promoted from lieutenant (junior grade), M. C. -F, December 19, 1936.

Lt. James E. Fulghum, M. C.-V (G), promoted from lieutenant (junior grade), M. C.-V (G), December 17, 1936.

NAVAL RESERVE OFFICER COMPLETES COURSE IN INTERNATIONAL LAW

Lt. Comdr. A. Jablons, Medical Corps, United States Naval Reserve, has completed the correspondence course in International Law of the Naval War College, Newport, R. I., and has received the certificate from the president of the War College.



NAVY RESERVE MEDICAL AND DENTAL SPECIALISTS. OCTOBER 8, 1936.

- | | | |
|---------------------------------|------------------------------|-----------------------------|
| 1. Lt. Comdr. Lincoln Humphreys | 9. Lt. Comdr. W. A. Stoops | 13. Lt. Comdr. U. S. Widman |
| 2. Brig. Gen. C. H. Mayo | 10. Lt. P. B. Walton | 14. Lt. Comdr. A. A. Stott |
| 3. Brig. Gen. W. J. Mayo | 11. Lt. J. J. Rupp | 15. Lt. B. G. Bailey |
| 4. Lt. Comdr. Waltman Walters | 12. Lt. Comdr. L. E. Dockery | 16. Lt. Comdr. L. A. Wylie |
| | | 17. Lt. R. P. Phillips |



JOHN MILLS BROWNE
Surgeon General of the Navy 1889-1893

260-2

NOTES AND COMMENTS

JOHN MILLS BROWNE, SURGEON GENERAL, UNITED STATES NAVY—1888-93

John Mills Browne, the thirteenth Chief of the Bureau of Medicine and Surgery, and the ninth to hold office as Surgeon General, was born in Hinsdale, N. H., on May 10, 1831. He graduated from the medical school of Harvard University in 1852, and was appointed an assistant surgeon in the Navy on March 25, 1853, from New Hampshire. His first duty was in the store ship *Warren* at Sausalito, Calif., across the bay from San Francisco. This ship, in September 1854, was anchored at Mare Island and became the residence of the first commandant of the navy yard, Comdr. David G. Farragut. The future Surgeon General of the Navy was thus the first medical officer of the Mare Island Navy Yard. His next sea service included surveying duty on the Pacific coast and experiences in an Indian war on the shores of Puget Sound. Promoted to a passed assistant surgeon on May 12, 1858, he served in the African Squadron, engaged in suppression of the slave trade. He was commissioned surgeon on June 19, 1861, and was soon ordered to the steam sloop *Kearsarge*. He was on that vessel as senior medical officer when, under the command of Comdr. John A. Winslow, she engaged and sunk the celebrated Confederate cruiser *Alabama*. Following the Civil War, he supervised the building of the Naval Hospital, Mare Island, Calif., and was the first medical officer in command of that hospital. He was fleet surgeon of the Pacific Fleet and, in 1883 when the Museum of Naval Hygiene was founded in Washington, he was ordered as its first director. He was appointed Surgeon General by President Cleveland on April 2, 1888, and held office until May 10, 1893. He retired in 1893, and his death occurred in Washington, December 7 of the following year.

Doctor Browne was a man of distinguished appearance and, what is unusual in a physician, was a gifted orator. He was particularly well known as an after-dinner speaker. He was prominent in the Masonic Order.

As showing the rate of promotion in the Medical Corps of the Navy in the period for a decade before the Civil War to the 1880's, the dates of his promotion to the various grades are given below:

Assistant surgeon, May 26, 1853.

Passed assistant surgeon, May 12, 1858.

Surgeon, June 19, 1861.

Medical inspector, December 1, 1871.

Medical director, October 6, 1878.

The decade between 1880 and 1890 saw the end of sails and of wooden hulls in our Navy, and the beginning of steel in the place of iron in construction. The new cruisers *Atlanta*, *Boston*, and *Chicago* were launched and the famous "White Squadron" organized. The new features of ship design affecting naval hygiene, the introduction of better ventilation, heating, lighting, berthing spaces, refrigeration, more adequate supply of distilled water and larger and better located sick bays were problems that were dealt with very largely in the regimes of Surgeons General Taylor, Wales, Gunnell, and Browne.

During the 20 years following the Civil War, the Medical Department of our Navy did much for the development of naval hygiene. In addition to the policy of publishing the medical statistics of the Navy, one of the most important contributions to modern preventive medicine, several medical officers made studies and published works that had great influence on the evolution of modern naval hygiene. Two of the most notable were Medical Director Joseph Wilson, Jr., and Albert H. Gihon. Both of these men wrote excellent books on naval hygiene and greatly stimulated interest in the subject, both here and abroad. Such important subjects as ventilation, water supply of ships, quarantine, epidemic diseases, and the proper precautions to observe in foreign ports and tropical countries to prevent diseases among the crew of the visiting ship; seasickness, poisonous fish and reptiles, alcoholism, venereal disease, clothing, recreation and the "moving of wounded men on ship board." This last feature was the beginning of the present excellent method followed by our Navy in the transportation of sick and wounded, a field which the Medical Department of the Navy has developed until the methods used are probably the best in the world. Wilson and Gihon were the inspiration of such men as James Markham Ambler, lost with the Jeannette Arctic expedition in the *Lena Delta*, and James Duncan Gatewood. Ambler was one of the first students of the subject to suggest that the absence of a certain unknown substance in foods was the cause of scurvy, a view confirmed by the later discovery of vitamins. Gatewood wrote a treatise on naval hygiene used by our own and a number of foreign navies, and was the pioneer in the scientific studies of the Navy ration.

The Assistant Chiefs of Bureau during the Surgeon Generalcy of Browne were Surgeons W. K. Van Reyphen, and J. C. Boyd.

CAUTION IN REGARD TO THE USE OF THE PROVOCATIVE WASSERMANN

The Memoranda on Venereal Diseases, 1936, prepared and published by the Army Medical Service of the British Army, contains many useful hints in regard to the diagnosis and treatment of these conditions. One of them deals with the subject of provocative injections and sounds a note of warning in regard to them well worthy of attention. The point made is so practical that it is quoted here:

Suppose the patient is seen in what is known as the early primary stage of invasion, his diagnosis is doubtful, as the medical officer has been unable to find the *T. pallidum* at his first examination, and the appearance of the sore gives no help. A provocative injection is given, but the following Wassermann reaction is negative. The patient is told that he has soft sore and goes on his way rejoicing. While the first dose of arsenic, i. e., the provocative one, is being absorbed, the body finds that there is no need for the production of antibodies to the *T. pallidum*, as the arsenic is killing them off. When the action of the arsenic ends, the unfortunate patient is left with a large infection (it is large compared with that at the time of appearance of his primary sore) by treponemata, against which he has no protection.

A CENSUS OF THE PERIODIC LITERATURE ON SYPHILIS

An examination of the number of published articles in medical journals upon syphilis cannot but impress one with the fact that the periodic literature on this subject is so voluminous that even the syphilologist is scarcely able to become familiar with all of it. A conservative estimate shows that in the last 10 years an average of more than 1,000 articles on the subject are published annually, or a total of 10,000 articles during the past decade.

CLINICAL EVIDENCE OF THE TOXIC EFFECTS FROM INJECTIONS OF ORGANIC ARSENICAL COMPOUNDS

Much information of the greatest importance can be obtained in regard to the intolerance of patients to arsenicals by the asking of careful questions. Patients under treatment for syphilis should be examined previous to each injection and the following or similar questions asked. These questions are designed to bring out pertinent facts in regard to various parts of the body likely to show injury from the drug:

1. Has there been any gain or loss of weight since the last injection?
2. Has there been any reduction or increase in the quantity of urine passed? (Urine examination to determine presence of albumin or casts also.)
3. Has there been any itching or any rash following the last injection?

119437—87—8

4. Is there any jaundice?
5. Has there been any loss of appetite, any vomiting, or any diarrhea?
6. Has there been any soreness of the mouth?
7. Has there been any feeling of weakness or giddiness; any pain or distress over the heart?
8. Has there been any fever?
9. Has there been any headache, any nervous or mental changes?
10. Was there, following the last injection, any "flare up" of general or local symptoms?

There is very little likelihood of toxic effects from arsenicals passing unnoticed if the examination includes the careful questioning outlined above, each question designed to bring out signs and symptoms in organs or systems of the body particularly likely to be affected.

SOME NEW METHODS SUGGESTED IN THE TREATMENT OF BURNS

Any new development in the treatment of burns is always of interest to the naval surgeon. In Germany and in England numerous clinical studies and reports have been made on the use of cod-liver oil in the treatment, not only of burns but of infected wounds, chronic ulcers, and fistulas. The oil appears to contain a factor (believed to be vitamin A) which stimulates epithelial growth. One advantage is that it may be applied over previous oily dressings without extensive skin toilet of the burn. Gauze heavily soaked in cod-liver oil is applied over the burn and left on for 48 hours. At the end of the first 24 hours the gauze is resoaked with the oil. Oiled paper covering to the dressing is used to protect the bedding. Those who have reported on this treatment state that indolent areas begin to granulate with remarkable speed; and furthermore, it gives comfort to the patients, nearly all of whom have testified to lessening of pain. The greatest disadvantage is the odor.

Rose and Jensen, of King County Hospital, Seattle, Wash., suggest as an initial treatment for burns the application of cold water. They use water at a temperature of 60° to 70° F. and gradually increase the temperature so that by the beginning of the third hour it is about 98°, when they generally give one-fourth grain of morphine preparatory to mild debridement. After the burned areas are clean the patient is placed on a sterile sheet, and they follow this with the tannic acid and silver nitrate treatment, or similar method of crusting.

As is well known, shock is an important feature in severely burned patients, and at first it would seem rather dangerous to place a

shocked patient in a bath where the temperature is only 60° or 70°, but they report that the results are spectacular both as to relief of pain and response to shock. Pain is relieved in a few minutes, and the weak pulse of shock rapidly becomes stronger, the blood pressure rises, and the patient's color is improved. The idea of using cold water in burns was suggested by the relief of pain resulting from the immersion of a burned finger or hand in cold water, a thing which most people instinctively do. While hydrotherapy has been recommended for burns many times, the advocates of this treatment say there has been no previous reference to cold water.

Details in respect to this treatment are given in an article published in the July number of Northwest Medicine. The Bureau feels that this treatment should be restricted to superficial burns of small areas until additional reports have been published regarding cases where shock is a feature.

BOUND SETS OF THE UNITED STATES NAVAL MEDICAL BULLETIN

Requests for reprints of articles published in the United States Naval Medical Bulletin many years ago, or of old copies of the Bulletin, are frequently received both from medical officers of the Navy and from civilian medical men or other agencies such as medical libraries, insurance companies, and industrial firms. For the benefit of medical officers of the Navy who may wish to consult the old files of the Bulletin when preparing professional papers or studying a case or for some such purpose, attention is directed to the fact that all naval hospitals both within and beyond the continental limits of the United States, the Naval Academy, the hospital ship, and the Naval Medical School have for many years received bound volumes of the Bulletin for their libraries. Consequently these places have bound sets of the Bulletin extending back many years. Recently the medical supply depots, the Marine Barracks, training stations, and the Naval Station at Tutuila, Samoa, have been added to this list. Also several medical officers have bound sets.

The circulation of the United States Naval Medical Bulletin is now about 3,800 copies as the Bulletin goes not only to medical officers and dental officers, chief pharmacists and pharmacists, nurses of the Regular Navy, active and retired, but also to all members of the Medical and Dental Corps of the United States Naval Reserve. Furthermore, a great many medical schools and medical libraries, both in this country and abroad, subscribe for the Bulletin and bind their copies for preservation in their libraries.

It is believed that the information given here may be helpful to those seeking material from back numbers of the Bulletin and who may have access to one of the sets in the libraries mentioned.

THE DISCOVERY AND ISOLATION OF THE ACTIVE PRINCIPLE OF ERGOT

One of the most important discoveries in both pharmacology and clinical obstetrics and medicine made in recent years was that of Fred L. Adair and his associates, E. Davis, M. S. Klearasch, and R. R. Legault, who isolated in crystalline form the active principle of ergot considered to be responsible for nearly all if not all of the oxytocic effects of the drug. The importance may be better appreciated when the advantages over the fluid extract are described. The principle isolated, which the discoverers have named *ergotocin*, and which is relatively nontoxic and free from undesirable effects, does not deteriorate quickly and is constant in its action. No detrimental effects were observed in the pulse, blood pressure, or urinary output. Its use will remove many of the serious failings of the fluid extract which contained many poisonous substances which were without action on the uterus, deteriorated rapidly, and often produced effects which contraindicated its use in certain cases of cardiovascular diseases.

The newly discovered alkaloid has also been called ergotocine, ergostertrine, and ergometrine.

RESEARCH ON SEASICKNESS

It is a remarkable thing that so few naval medical officers have made contributions to the professional literature on seasickness. The United States Naval Medical Bulletin contains but three listed entries in nearly 29 years of publication and but one of those entries is a formal article on the subject. Rear Admiral C. S. Butler, Medical Corps, United States Navy, some years ago, published an article on the treatment of seasickness in the Journal of the American Medical Association which is the only other contribution on the subject by an American naval medical officer. The Journal of the Royal Naval Medical Service is almost as bare of material on this subject. Indeed, it appears to be a neglected subject in the whole of medical literature and particularly lacking are any efforts at careful modern research. This is surprising as it is so common an affliction of sea travelers. It is like Mark Twain's weather, "everyone complains about it but no one does anything about it." Naval medical officers are most favorably situated to study seasickness and there is so much to be done in the way of research as to causes, both primary and secondary, treatment, and prophylactic measures, that it would seem that it should receive more attention than has been given to it. Here is a disease peculiarly a subject of naval and maritime medicine which has been neglected by naval medical officers and is a promising field for study.

THE HENRY S. WELLCOME MEDAL AND PRIZE**COMPETITION FOR 1937**

The competition is open to all medical department officers, former such officers, acting assistant and contract surgeons of the Army, Navy, Public Health Service, Organized Militia, United States Veterans' Administration, United States Volunteers, and the Reserves of the United States, commissioned medical officers of foreign military services, and all members of the association, except that no person shall be awarded a prize more than once in the prize competitions of the association. All competitors who are not already members of the association are eligible to membership, and the executive council of the association hopes that they will exercise their privilege and join.

A gold medal and a cash prize of \$500 will be given for the best paper on the following subject: The Contributions of the World War to the Advancement of Medicine.

Each competitor must furnish five copies of his competitive paper. Papers must not be signed with the true name of the writer, but are to be identified by a nom de plume or distinctive device. They must be forwarded to the Secretary of the Association of Military Surgeons of the United States, Army Medical Museum, Washington, D. C., so as to arrive at a date not later than August 15, 1937, and must be accompanied by a sealed envelope marked on the outside with the fictitious name or device assumed by the writer and enclosing his true name, title, and address. The length of the essays is fixed between a maximum of 10,000 words and a minimum of 3,000 words. The envelope accompanying the winning essay or report will be opened by the president of the association and the name of the successful contestant announced by him. The winning essay or report becomes the property of the association, and will be published in *The Military Surgeon*. Should the board of award see fit to designate any paper for first honorable mention the Executive Council may award the writer life membership in the Association of Military Surgeons, and his essay will also become the property of the association.

AMERICAN NEISSERIAN MEDICAL SOCIETY

The American Neisserian Medical Society is engaged in the promotion of knowledge in all that relates to the gonococcus and gonococcal infections. It is doing clinical and laboratory research in the diagnosis, the medical and social pathology, and the treatment of gonorrhea; scrutinizing the management of gonorrhea in both male and female; disseminating among the medical profession and the public authoritative information concerning gonorrhea.

Membership is limited to those who are residents of the United States or its Territories, Canada, Mexico, or islands adjacent thereto, are graduates of a medical school recognized by the American Medical Association and have engaged for at least 5 years in either the clinical, laboratory, research, public health, or sociological phase of the management of gonorrhea.

All qualified physicians who are interested in promoting the above activities are invited to apply for membership.

FEES FOR AMERICAN BOARD OF OPHTHALMOLOGY

On recommendation of the Advisory Board for Medical Specialties, the American Board of Ophthalmology, at its meeting in New York City on September 26, 1936, voted that effective of this date, doctors of the Army, Navy, or Public Health Service shall be required to pay the same application and certification fee (\$50) as is required of all civilian applicants.

The Board requires that \$25 of this fee shall accompany the application, the balance being payable at the time the certificate is issued. In the event of failure at examination no refund shall be made.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.
(For review.)

REMINGTON'S PRACTICE OF PHARMACY, revised by E. Fullerton Cook, P. D., chairman of the committee of revision of the Pharmacopoeia of the United States of America, and Charles H. LaWall, Ph. M., dean of pharmacy and professor of theory and practice of pharmacy of the Philadelphia College of Pharmacy and Science, and collaborators. 2,162 pages; numerous illustrations. Eighth edition. J. B. Lippincott Co., Philadelphia and London. 1936. Price \$10.

Remington's Practice constitutes really an encyclopedia of pharmacy. The first edition of this great book was published in 1885 and it may safely be said it has been the Bible of American pharmacists ever since. The book covers every phase of pharmacy; the history of pharmacy, the application of physics, botany, and chemistry, the commercial aspects of pharmacy, surgical dressings, ligatures, antiseptics and disinfectants, homeopathic pharmacy, toxicology, all are covered and covered completely. The preparations of the United States Pharmacopoeia, eleventh revision, the National Formulary, sixth edition, and the 1935 edition of the New and Non-Official Remedies, have been made the basis for this edition, and other important therapeutic agents and unofficial preparations have been included. A new section on hospital pharmacy has been added. An interesting feature of this is a plan for pharmaceutical internship. To this useful book there is a glossary of uncommon pharmaceutical and technical names, terms and substances, a glossary of medical terms, and a section of useful formulas. An idea of the scope of the book is perhaps well given by the fact that there are 141 pages of index.

PRACTICE OF MEDICINE, by Jonathan Campbell Meakins, M. D., L. L. D., Professor of medicine, Guild University. 1343 pages; 505 illustrations, including 35 in color. The C. V. Mosby Co., St. Louis, 1936. Price \$10.

This new Practice approaches each disease from the standpoint of symptoms. In other words the foremost things are the complaints

which cause the patient to seek the physician. These symptoms are linked to disturbances of functions and to pathological conditions behind these disturbances. The first chapter is an introduction to the practice of medicine and is one of the most interesting in the book. It begins with a plea that the age of specialties not drive out the time-honored "family doctor", and this is followed by the statement of certain fundamental principles from which the practice of medicine is derived. Although written by one man, certain chapters and sections have been prepared by specialists in their field. This applies particularly to diseases of nervous system, diseases of the urinary system, and diseases of the ductless gland. There is an interesting chapter devoted to diseases of the locomotor system, diseases due to allergy, diseases due to abnormal environments, and very practical chapters on diseases due to chemicals and drugs. Infectious diseases conveyed by parenteral inoculation are discussed. The treatment of these conditions are described under the headings of Prevention, General Treatment, Local Treatment, and Specific Treatment, if any exists. Each chapter concludes with a list of important references.

A departure in this book from other textbooks of the practice of medicine is in respect to illustrations. It is the only Practice in which much has been made of pictures. These are numerous and excellent.

A TEXTBOOK OF MEDICINE, by Charles Phillips Emerson, M. D., research professor of medicine, Indiana University. 1,296 pages. J. B. Lippincott Co. 1936. Price \$8.00.

This Textbook of Medicine differs from that of Meakin's in that it has no illustrations. The presentation of the subject matter, however, has several interesting features. In the first place, the clinical syndrome of each disease is clearly given including the cause, the incidence, symptoms, type, complications, and treatment. Pathology and other special features from the medical sciences in connection with the disease are given in a different type. Another unique feature is the historic note which accompanies nearly every disease and even a sort of thumb-nail biography of some of the men who have made contributions of particular importance are given. Another feature of particular value is the attitude expressed toward symptoms as evidences of protective biologic reactions on the part of the patients. And, finally, emphasis is given to the fact that the clinical case must be looked at not only from the standpoint of bacteriology and biochemistry, but of psychology, and the individual patient dealt with as a personality. In other words, there is an expression of the practice of medicine as an art as well as a science. The book itself is the work of one man and has therefore a certain coherence difficult of

obtainment when a number of authors have collaborated in the production of a book. Altogether it is a splendid practice of medicine by an American author.

ANATOMY OF THE HUMAN BODY, by *Henry Gray, F. R. S., and revised by Warren H. Lewis, M. D., professor of physiological anatomy, Johns Hopkins University.* 1,381 pages; 1,216 engravings. Twenty-third edition. Lea & Febiger, Philadelphia. 1936. Price, \$10.

Perhaps the best known work in English medical literature is Osler's Practical Medicine, but without a competitor for second place at least, and perhaps a strong competitor for first place, is Gray's Anatomy itself. It is not a little remarkable that Henry Gray, who died at the early age of 36, should have produced what amounts to a masterpiece in science which contains so extensive and minute an array of facts as does anatomy. Much of its lasting success was due to his great ability as a teacher, which resulted in a remarkably clear and systematic presentation of the subject. The magnificent anatomic illustrations which were a feature of the first edition published in 1858 have been repeated, and those added in subsequent editions have been equally fine.

TEXTBOOK OF GENERAL SURGERY, by *Warren H. Cole, M. D., F. A. C. S., professor of surgery, University of Illinois College of Medicine, and Robert Elman, M. D., associate professor of surgery, Washington University School of Medicine, St. Louis.* 1,031 pages; many illustrations. D. Appleton-Century Co., New York and London. 1936. Price, \$10.

"Eminently practical" are the two words that best describe this text if a description were limited to two words. There are no frills nor fancies. It is a book written by two able surgeons who are also teachers of surgery and who have drawn on their teaching experience for the best methods of presenting the subject to the medical student and general practitioner. Descriptions of many diseases, their conditions, diagnosis, and prognosis and treatment are given very fully. Operative technique, except for some common conditions, has been reduced, as it was felt that the details of operating treatment are so voluminous that they could not be included in a single volume and that books devoted to operative surgery should be consulted for the details of technique. A refreshing feature of this book are the many new illustrations; so many of our textbooks have used the same old pictures from previous illustrations that it is a pleasure to pick up a book where practically all of the pictures appear for the first time. They are excellent, as is also the printing and binding.

THE SCIENCE OF DENTAL MATERIALS, by *Eugene W. Skinner, Ph. D., associate professor of physics, Northwestern University Dental School.* 411 pages; 131 illustrations. W. B. Saunders Co., Philadelphia and London. Price, \$4.50.

The author provides a textbook in which scientific information relating to dental materials and their manipulation is presented in a

well-organized manner. Because of disagreement existing among educators as to a proper sequence of subjects in such a work, effort is made to provide an arrangement of matter in a form sufficiently flexible to be adapted to individual ideas of various instructors. Valuable data and photographs from original researches dealing with steel, stainless steel, and manipulation of steel in dentistry contributed to the work in chapters XXXVI-XXXVIII are suitably acknowledged by the author.

The book is an important contribution to dental literature and valuable as a textbook for dental students and as a reference for dental practitioners.

ORAL DIAGNOSIS AND TREATMENT PLANNING, by *Kurt H. Thoma, D. M. D., Charles A. Brackett, Professor of Oral Pathology in Harvard University; Oral Surgeons to the Brooks Hospital.* 379 pages with 533 illustrations, 71 of them in colors. W. B. Saunders Co., Philadelphia and London. 1936. Price \$6.

This book deals with diseases and abnormalities of the teeth, jaws, and oral tissues. Primary lesions, secondary manifestations, and somatic diseases, occasioned by oral infection, are efficiently considered and described. Special attention is given to treatment planning, methods of examination, and to diagnosis of dental and oral diseases. The author devotes a page of the book to instructions in its use, and its value is enhanced through a close following of the instructions offered.

Examination methods and diagnostic aids are suggested, and the etiology, symptomatology, and pathologic development of dental and oral diseases are carefully reviewed. The large number of colored illustrations of many varieties of oral lesions add to the importance of the work. This book has a distinct value as a reference work and textbook for physicians and dentists.

MODERN UROLOGY. *An original contribution by American authors, edited by Hugh Cabot, M. D., LL. D.* Two volumes of 951 and 862 pages. Illustrated with numerous engravings and plates. Third edition. Lea & Febiger, Philadelphia. 1936. Price \$20.

This is a complete revision under the editorship of Hugh Cabot, with the various parts prepared by some of the most noted surgeons and urologists, including Keyes, Hinman, Cecil, Braasch. Nothing has been left undone to make the work not only a textbook, but because of the richness and variety of illustrations, almost an atlas and an encyclopedia of urology. Each section concludes with an excellent bibliography.

PRACTICAL EXAMINATION OF PERSONALITY AND BEHAVIOR DISORDERS, ADULTS AND CHILDREN, by *Kenneth E. Appel, M. D., Assistant Professor of Psychiatry, University of Pennsylvania, and Edward A. Strecker, M. D., Professor of Psychiatry, University of Pennsylvania.* 219 pages; no illustrations. The Macmillan Company, New York. 1936. Price \$2.

This is a practical handbook on case taking for use in the examination of psychiatric patients, both adults and children, and is of value to the student, general practitioner, psychiatrist, educational counselor, social worker, minister, teacher, and parent.

DISEASES OF THE NAILS, by *V. Pardo-Castello, M. D. Formerly Assistant Professor of Dermatology and Syphilology, University of Havana.* 177 pages; illustrated. Charles C. Thomas, Springfield and Baltimore. 1936.

This is a much-needed monograph, for it is probably the only book in English devoted entirely to this rather neglected subject, a neglect that has often embarrassed not only the general practitioner but the dermatologist, both of whom have often been at loss for a correct diagnosis or treatment of diseases of the nails. The book is excellent. There is a fine little table of ungueal symptoms due to poisons, another table showing occupations in which the various diseases of the nails are common and the cause, and a good bibliography.

ROENTGEN INTERPRETATION, A MANUAL FOR STUDENTS AND PRACTITIONERS, by *George W. Holmes, M. D., Clinical Professor of Roentgenology, Harvard Medical School, and Howard E. Ruggles, M. D., Clinical Professor of Roentgenology, University of California Medical School.* 356 pages. 243 engravings. Fifth edition. Lea and Febiger, Philadelphia. 1936. Price \$5.

Holmes and Ruggles have been a Bible for a good many busy doctors, including a number of roentgenologists. This is the fifth edition of this standard work, and every effort has been expended to bring it up to date. The revision covers improvements in fluoroscopic technic, especially as relating to new equipment, protection, accommodation, secondary current, and the procedure in the examination for foreign bodies.

PRINCIPLES OF HUMAN PHYSIOLOGY, by *Ernest H. Starling, F. R. S., edited and revised by C. Lovatt Evans, F. R. S., Jodrell Professor of Physiology in University College, London, and H. Hartridge, F. R. S., Professor of Physiology at St. Bartholomew's Medical College.* 1,109 pages. 554 engravings, 6 in color. Seventh edition. Lea and Febiger, Philadelphia. 1936. Price \$8.75.

Starling's Principles of Human Physiology has long been a classic work on the subject, and two English physiology professors have now thoroughly revised it and brought the book up to date. The structure of vitamins, the advances in knowledge of the chemistry of the hormones, the humoral transmission of nervous impulses, the chemistry of the carriage of carbon dioxide in the blood, and other important developments have been included in this edition.

A TEXTBOOK OF PHARMACOLOGY AND THERAPEUTICS, OR THE ACTION OF DRUGS IN HEALTH AND DISEASE, by *Arthur R. Cushny, M. A., M. D., F. R. S., Late Professor of Materia Medica and Pharmacology in the University of Edinburgh, and revised by C. W. Edmunds, M. D., Professor of Materia Medica and Therapeutics in the University of Michigan, and J. A. Gunn, M. D., Professor of Pharmacology, University of Oxford, Oxford, England.* 808 pages. 70 engravings. Eleventh edition. Lea and Febiger, Philadelphia. 1936. Price \$6.50.

The same authors who in 1934 brought out the tenth edition of Cushny have now produced the eleventh edition, in order to bring this book into harmony with the eleventh decennial revision of the Pharmacopoeia of the United States. It is unnecessary to mention the excellence of Cushny's book, as it is one of the great textbooks of medicine, written by one of the great medical men of our time.

HOLT'S DISEASES OF INFANCY AND CHILDHOOD, by the late *L. Emmett Holt, M. D., and John Howland, M. D. Revised by L. Emmett Holt, Jr., M. D., Associate Professor of Pediatrics, John Hopkins University, and Rustin McIntosh, M. D., Carpentier Professor of Diseases of Children, Columbia University.* 1,240 pages; illustrated. Tenth edition. D. Appleton-Century Co., New York and London. Price \$10.

This is a thorough revision of one of the most important American texts on the diseases of children. Sections on deficiency diseases, allergy, and diseases of the blood have been completely rewritten, as have those on diabetes mellitus, the care of premature infants, and the articles on tuberculosis and the common cold. Among the new material added is a chapter on lead poisoning in childhood. At the end of each chapter is a brief bibliography of important references.

MEDICINE AND MANKIND, Edited by *Iago Gladston, M. D.* 217 pages. D. Appleton-Century Co., New York and London. 1936. Price \$2.

This little book is a collection of lectures delivered to the laity at the New York Academy of Medicine. Among the lecturers are Alexis Carrel, Harlow Brooks, and Elmer V. McCollum. Some of the subjects of particular interest are: The Contributions of the Primitive American to Medicine; The Story of the Vitamins; The Mystery of Death; and Medicine in the Days of Louis the Fourteenth.

TEXT-BOOK OF PHYSIOLOGY, FOR MEDICAL STUDENTS AND PHYSICIANS, by *William H. Howell, M. D., emeritus professor of physiology in the Johns Hopkins University, Baltimore.* 1,150 pages; illustrated. Thirteenth edition. W. B. Saunders Co., Philadelphia and London. 1936. Price \$7.

Howell's Physiology has become like Gray's or Cunningham's Anatomy, an indispensable book to the medical students and physicians. This thirteenth edition has been thoroughly revised and the latest discoveries incorporated in it. Particularly new are facts regarding the chemical nature and structure of hormones.

PROCTOLOGY, by *Frank C. Yeomans, M. D., F. A. C. S., professor of proctology, New York Polyclinic Medical School.* 661 pages; 421 illustrations; 4 colored plates. Second edition. D. Appleton-Century Co., New York and London. 1936. Price \$12.

It is 7 years since the first edition of Yeomans' Proctology was printed. This new revision contains many changes and additions. The injection treatment of hemorrhoids, recent views on the etiology and therapy of chronic ulcerative colitis, lymphopathia venerea in the etiology of rectal stricture, statistics of the results of treatment of rectal carcinoma by irradiation and by excision are among some of the important features which have either been added or rewritten. There are 25 new illustrations.

PRINCIPLES OF CHEMISTRY, by *Joseph H. Roe, Ph. D., professor of biochemistry, School of Medicine, George Washington University.* 475 pages; illustrated. Fourth edition. The C. V. Mosby Co., St. Louis. 1936. Price \$2.75.

This is the fourth edition of an excellent introductory textbook in chemistry, especially suitable for high schools and for nurses, students of home economics and applied chemistry. It covers the fundamentals not only of general chemistry and organic chemistry, but of physiological chemistry, organic chemistry, and elementary biochemistry. I know of no other elementary textbook in chemistry that does this. There are tables of the nutritive value of foods in the appendix and an excellent glossary of the chemistries. Furthermore, the book contains a laboratory manual. While the book is illustrated, a few more carefully selected pictures would add to its interest and usefulness.

PUBLIC HEALTH AND HYGIENE, A STUDENTS' MANUAL, by *Charles Frederick Bolduan, M. D., Director, Bureau of Health Education, City of New York, Public Health Service, and Nils W. Bolduan, M. D., Children's Medical Service, Bellevue Hospital, New York.* 371 pages; illustrated. Second edition. W. B. Saunders Co., Philadelphia, London. 1936. Price, \$2.75.

The second edition of this excellent little manual of public health has been extensively rewritten and the whole book brought very well up to date. Five new chapters have been added. An interesting feature of the book is the historical approach. The first 45 pages are taken up with a brief, excellent history of preventive medicine, and furthermore, each subject as it is taken up in the book is preceded by a brief but splendid review of the history of the subject.

TISSUE IMMUNITY, by *Reuben L. Kahn, M. S., D. Sc., University of Michigan.* 707 pages. Many charts and line cuts. Charles C. Thomas, Maryland. 1936. Price, \$7.50.

Dr. Kahn is known to medical men all over the world through their acquaintance with the Kahn test. He has now written a striking book on the subject of immunity. This book presents many new features of the subject, and it presents them in a remarkably simple

and explicit way. As a consequence, many ideas in regard to immunity and allergy hitherto vague and ill-defined in the minds of many will be crystalized and seen more clearly. The author shows immunity to be a physiological function of all cells and, furthermore, a function which develops from immaturity to maturity as do other physiological functions. It is less in a child than it is in the adult. Allergy is seen as a hyperimmunity, as an overresponse to an antigen; in other words, the using of a 16-inch gun to kill a mosquito. Desensitization is regarded as a disimmunization to the antigen. Immunity is not only an inherent quality of all tissue, but each tissue possesses it in different degrees and has different capabilities for immunization. A feature of the book is the experimental outline followed. Points are substantiated and explained by simple experiments which would make it almost a practical laboratory manual to experimental pathologists and pharmacologists. The practical possibilities of immunization revealed are numerous, but Dr. Kahn ends on a conservative note and points out many of the dangers in loading the body with various and miscellaneous antigens in well-meant attempts at disease prevention.

DISEASES OF WOMEN, by Harry Sturgeon Crossen, M. D., F. A. C. S., Professor Emeritus of Clinical Gynecology, Washington University School of Medicine, and Robert James Crossen, M. D., Instructor in Clinical Gynecology and Obstetrics, Washington University School of Medicine. 999 pages. 1,058 engravings, including one color plate. Eighth edition. The C. V. Mosby Co., St. Louis. 1935. Price, \$10.

The writer of this review used a fourth edition of Crossen published in 1910 as a text when a medical student. A feature of that edition and of all subsequent ones is the great attention given to case taking and physical diagnosis. Indeed, Crossen furnishes a real course in abdominal diagnosis and in case taking of the utmost value to the medical student and general practitioner, aside from the value of the book as a gynecology. Another feature of this book is the splendid illustrations and their number. It is almost an atlas of gynecology as well as a textbook. In the present edition much attention has been given to advances from endocrine study. Many advances in gynecology in recent years have made it necessary, in fact, to entirely rewrite and reset the book, and apparently no effort or money has been spared to bring this well-known American textbook up to date.

A TEXTBOOK ON OBSTETRICS, by Edward A. Schumann, A. B., M. D., F. A. C. S., Professor of Obstetrics, School of Medicine, University of Pennsylvania. 780 pages with 581 illustrations on 497 figures. W. B. Saunders Co., Philadelphia and London. 1936. Price \$6.50.

Doctor Schumann's work is somewhat of a departure from the usual textbook on obstetrics in respect to size. Most obstetrical

textbooks are rather bulky volumes, while this is a handy manual size. This innovation has been accomplished largely by removal of everything except the really essential things that are of practical value and the omission of theoretical subjects. A great deal of attention has been devoted to the physiology of pregnancy, the mechanics of labor, and the conduct of normal labor. Rare conditions are merely sketched. Its moderate size, moderate price, and excellent practical features make this a useful book to the medical student and practitioner.

A MANUAL OF PHARMACOLOGY, by *Torald Sollmann, M. D., Professor of Pharmacology and Materia Medica in the School of Medicine of Western Reserve University*. 1190 pages. 22 illustrations. Fifth edition. W. B. Saunders Co., Philadelphia and London. 1936. Price \$7.50.

This is the fifth edition of an old standard American classic in pharmacology. The writer of this notice was brought up on Sollmann; it was *the book* of the pharmacological department at the school from which he graduated. Sollmann's Manual has always been outstanding, particularly in respect to pharmacodynamics. Probably no other book gives better knowledge regarding the action of drugs and the experimental methods on which the knowledge is based, and with it a sound basis for all therapeutics.

An illuminating feature of the book is a section devoted to treatment and the philosophy of therapeutics. There is an excellent bibliography and appendix. The whole book has been entirely reset and brought up to date to include changes made necessary by the latest revisions of the United States Pharmacopoeia and the National Formulary.

DISEASES OF THE RESPIRATORY TRACT.—*Clinical Lectures of the Graduate Fortnight of the New York Academy of Medicine*. Octavo of 418 pages, illustrated. Cloth. W. B. Saunders Co. Philadelphia and London. 1936. Price, \$5.50.

This important subject is very well covered, thoroughly up to date, and written primarily for the general practitioner. There are 21 eminent contributors. It is only natural with this number of contributors that one finds some overlapping of subjects and minor contradictions. This, however, serves as an added advantage, as it gives the reader the opinions of various authors instead of one. One is reminded of the importance of the subject matter of this book by Dr. Eugene H. Pool's opening remarks: "In spite of the great advances in diagnosis, treatment, and prevention, the diseases of the respiratory tract account for more illness and deaths than any other system, except the heart and blood vessels."

This brief, up-to-date, well-written book deserves a place in every library.

A TEXTBOOK OF PATHOLOGY, by W. G. MacCallum, professor of pathology and bacteriology, the Johns Hopkins University. Sixth edition. 1,277 pages, illustrated. W. B. Saunders Co., Philadelphia. 1936. \$10.

As a students' textbook in pathology this work needs no introduction, for previous editions have been widely used in medical schools. The general practitioner and the pathologist will find in it a very valuable aid. The subject matter is logically arranged and deals with diseases both from the standpoint of cause and effect.

Chapters on virus diseases, including lymphogranuloma inguinale, on diseases affecting the teeth, and on conditions of undetermined etiology affecting the central nervous system or muscles, have been added. Diseases caused by fungi have been grouped in one chapter. The chapters dealing with deficiency diseases, disorders of the organs of internal secretion, diseases of undetermined origin affecting bones, and those concerning tumors have been added to and amplified. In the previous editions very little was said concerning ovarian tumors, but this lack has been remedied in the present work. A paragraph on Wilson's disease has been included in diseases affecting the liver.

The book is rich in pictures of both gross and microscopic pathology. Each subject is supplemented by references to literature for those wishing additional and more detailed information.

A TEXT-BOOK OF NEURO-ANATOMY, by Albert Kuntz, Ph. D., M. D., professor of micro-anatomy in St. Louis University School of Medicine. Second edition, illustrated with 307 engravings. Lea & Febiger, Philadelphia. 1936. Pp. 519. \$8.50

This excellent new edition is larger than the first by 160 pages and 110 illustrations. The style and manner of handling the material remain much the same. They remind one of the well-known periodical that claims the virtue of being "curt, clear, concise", and the illustrations are equally intelligible.

In the opening paragraph appears the attention-arresting statement that "the fundamental plan of structure in the vertebrate nervous system is relatively simple." This remark, which is such a violent contrast to the common belief that nothing, except the stellar universe itself, is more complicated than the nervous system, challenges the reader to continue on, and find whether the writer can prove his point. Certainly, he does make it appear simpler and more understandable than does any other book on the subject, that is known to the reviewer.

It opens with the evolution of the nervous system through the invertebrates, vertebrates, and mammals, with a consideration of the forces influencing the development. At the end of each chapter is a summary, giving in a few short paragraphs the essential points of the chapter. There is a laboratory outline, which details the methods of study and gives directions for dissection of the nervous

system. At the end is a feature that might well be enlarged; some 14 cases are quoted as clinical illustrations, showing the relation of lesions in various parts of the nervous system to symptoms and signs that may be elicited by the clinician.

The chapter on the autonomic nervous system will be of special interest to surgeons. It is most complete in its exposition of the plexuses and the conduction pathways in their relations to function.

As a whole, there is every indication that it will prove a valuable book both for the student and for the practitioner.

NEUROLOGICAL SURGERY, by *Loyal Davis, M. S., M. D., Ph. D., D. Sc. (Hon.)*, professor of surgery and chairman of the division of surgery, Northwestern University Medical School, Chicago. Illinois, 172 engravings, 2 plates. Lea & Febiger, Philadelphia. 1936. \$6. P. 429.

There can be little doubt that the most important advances in surgery during the coming decade will be in the treatment of lesions of the nervous system. Within the professional life of many of us, knowledge in this field has progressed from practically zero to the present status, and we now approach with confidence almost any portion of this system. There is nothing to suggest any slackening of this rate of advance. Since 1900 the foundation of diagnosis, operative indications, and surgical technique has been solidly laid, and on it will be built advances that will enable us to aid the afflicted who, but recently, were doomed to suffer and die while the surgeon looked on, helpless to relieve them.

In this book is a compact analysis of our present knowledge of neurological surgery, presented in such readable form that neurology loses much of its dreary aspect and becomes filled with interesting speculations.

Neurologists need to know when to ask the surgeon in for consultation, and surgeons need to know when to recommend operation and what are the chances of success. Both groups will be helped by studying this book.

X-RAY TECHNIQUE AND INTERPRETATION OF DENTAL ROENTGENOGRAMS, by *A. L. Greenfield, D. D. S.*, associate professor of roentgenology at the New York University College of Dentistry, lieutenant (D. C.), United States Naval Reserve. 254 pages, with 466 illustrations. Dental Items of Interest Publishing Co., Inc., Brooklyn. Great Britain: Henry Kimptons Medical Publishing House. 1936. Price, \$6.

The essentials of X-ray technique and interpretation are presented in this book in a clear and efficient manner. Physics of X-ray, pulp vitality testing, and methods of film placing, processing, and mounting are presented in systematic arrangement. Illustrations are numerous, excellent, and helpful. A large part of this work is devoted to the radiographic appearance of oral pathological conditions, and X-ray interpretations of many such conditions are furnished in

119437—37—9

illuminating discussions. The book is a valuable addition to the literature on dental roentgenology and has in this respect a special value for dental and medical practitioners.

MANUAL OF DENTAL ROENTGENOLOGY, by *S. S. Wald, D. D. S., head of the department of roentgenology of the Murry and Leonie Guggenheim Dental Clinic and School for Dental Hygienists, New York City.* Copyright, 1936. Printed in United States of America.

The author provides in this book a compact and clear description of a valuable technique for dental radiography. To facilitate the application of the described technique a large number of excellent photographs are supplied. The text is the result of the author's long experience, and a close following of the details presented should result in successful dental radiographs. The importance of the minimum number of films specified in full mouth X-ray for satisfactory representation of the regions examined is stressed. The book is considered especially valuable for dental students and hygienists.

ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES DURING THE YEAR 1936

The following is a brief résumé or calendar of the more recent advances in the clinical branches of medicine, as well as the medical sciences. An attempt has been made to confine it to discoveries or important advances that were made during the past year, though this has not always been possible as some of the work extends several years back and has only become recognized during 1935. Furthermore, it is naturally possible in so brief a compass as a few pages to mention but the most outstanding achievements. With work so recent, too, it is difficult to appraise with absolute accuracy that which will stand the test of future experience.

The calendar of recent advances in the medical sciences published in the April numbers of the *BULLETIN* during the past 3 years has proved so popular that it has been decided to repeat it each year. As in the résumé of last year, only the most outstanding events are mentioned and as far as possible limited to advances made in 1935, though this latter purpose cannot always be realized as the original work may have been done on a subject in previous years and brought to a final and successful conclusion in 1935. Of course, it is also obvious that when discoveries so recent have to be appraised without the trial of use which time alone can give, errors of commission or omission may naturally result.

MEDICINE

The use of protamine insulinate in the treatment of diabetes has been developed and studied during the year and has been declared to be "the most valuable discovery in the treatment of diabetes since the original discovery of insulin."

Theelin, one of the most important of the female sex hormones, was produced by synthesis.

The use of meningococcus antitoxin intravenously is considered by Dr. Archibald L. Hoyne, of Chicago, to be a more effective method of treating epidemic meningitis than injections into the spinal canal.

The addition of potassium bromide to egg white and subsequent incubation provides a substance which reduces the blood clotting time of hemophiliacs and it is believed to be the most important advance

in the treatment of this condition which has hitherto been made. This work was done by Drs. Timperley, Naish, and Clark, of the University of Sheffield, England.

Drs. Eley and McKhann, of Boston, report the successful use of placental extract in the treatment of hemophilia.

Dietetic treatment of Addison's disease by a diet low in potassium and proper amounts of salt and sodium citrate has proven most successful. This work was done at the Mayo Clinic.

Mussel poisoning from the eating of California rock mussels at certain times of the year has been traced to the infection by the mussels of a poisonous phosphorescent microorganism found in the sea. It is called the *Gonyaulax catenella*.

SURGERY

The use of a chemical known as Prontosil in the treatment of hemolytic streptococcus infections has proved to be very successful according to many reports received both in England and from this country. The chemical was first produced in Germany.

To reduce the internal pressure of the abdomen in cases of acute intestinal obstruction and other serious abdominal conditions, Dr. Wangenstein, of the University of Minneapolis, has successfully employed a retention duodenal tube.

PEDIATRICS

Probably the most important development during the year in pediatrics has been the advocacy of the use of iron salts in quantities not to exceed the physiological limits in the diet of infants after the second month. Jeans, of the University of Iowa, urges the value of iron for the infant. It is used in conjunction with cod-liver oil and orange juice.

PREVENTIVE MEDICINE

The Rockefeller Foundation reports the cultivation of a new strain of yellow fever virus which promises a safer and more effective vaccination against yellow fever.

Development of an improved rabies vaccine which may be employed with far less risk than the vaccination in use at present is reported by the Rockefeller Institute.

An important function of the cortex of the adrenal glands is found to be that of regulating the amount of potassium in the blood. This work was done by Drs. Zwemer and Truszkowski of the Columbia University.

Further evidence that the heat regulating center is in the hypothalamic region of the brain was developed by Dr. Ranson at the Northwestern University Medical School.

RADIOLOGY

A baffle screen which deflects secondary electrons in the X-ray, developed by Dr. Failla of Memorial Hospital, provides better protection from X-ray burns.

Professor Bunker and Dr. Harris of the Massachusetts Institute of Technology report that five wavelengths of ultraviolet light are the ones principally responsible for the prevention and cure of experimental rickets.

BACTERIOLOGY

Evidence that the inanimate protein molecules may take on many characteristics of living bacteria and are probably disease producing agents has been brought forward by Dr. W. M. Stanley of the Rockefeller Institute and his associates. Dr. Stanley's work indicates that the virus disease of plants are caused by protein molecules which appear capable of multiplying, producing toxins capable of causing the hosts to produce antibodies, and in other ways appear like living organisms.

CANCER

Injection of micro-organisms, particularly colon bacilli and meningococci, resulted in hemorrhage in the mouse cancer and distribution in the tumor. This work was reported by Dr. Andervont. of the United States Public Health Service.

Dr. Hammett of Philadelphia reports that mice afflicted with tumors lived longer and that the growth of the tumor was checked by the injection of cystine disulfoxide.

Studies at the United States National Institute of Health indicate that cancer tissue has approximately the same nourishment requirements as normal tissue. Growths of cancer in mice were checked by diets deficient in cystine and stimulated by glutathione.

THE NOBEL PRIZE IN MEDICINE FOR 1936

This was received jointly by Sir Henry Hallet Dale of the National Institute of Medical Research, London, and Dr. Otto Loewi of the University of Graz, Austria, for work on the chemistry of the transmission of nervous impulse.

THE DIVISION OF PREVENTIVE MEDICINE

O. S. STEPHENSON, Commander, Medical Corps, United States Navy, in charge

HEALTH OF THE NAVY

The following tables are summaries of morbidity rates per 1,000 for the third quarter of 1936 in comparison with rates for the corresponding quarter of the preceding 5 years:

ENTIRE NAVY

Year	All diseases	Injuries	Poisonings	All causes	Communicable diseases		Venereal diseases
					A	B	
1931.....	470	59	0.47	530	(1)	(1)	142
1932.....	549	54	.62	604	(1)	(1)	141
1933.....	404	65	7.10	478	9	86	115
1934.....	510	65	4.28	580	21	120	106
1935.....	373	53	.25	426	12	92	75
1936.....	336	60	7.18	404	24	88	49

FORCES ASHORE

1931.....	542	40	0.30	583	(1)	(1)	93
1932.....	544	85	.93	629	(1)	(1)	107
1933.....	382	74	10.81	456	7	66	72
1934.....	637	91	1.35	730	31	181	64
1935.....	426	57	.20	484	14	127	43
1936.....	416	50	19.19	466	29	120	38

FORCES AFLOAT

1931.....	432	70	0.56	502	(1)	(1)	169
1932.....	552	37	.45	590	(1)	(1)	159
1933.....	414	61	5.32	481	10	95	136
1934.....	449	53	5.69	507	16	91	125
1935.....	343	51	.27	395	11	72	92
1936.....	291	66	.80	357	21	70	55

¹ Not available.

Common infectious diseases of the respiratory type.—A total of 2,269 cases of these diseases was reported from the entire Navy for the quarter—1,216 from Forces Afloat, 988 from shore stations in the United States, and 65 from foreign shore stations. A 16 percent decrease is noted from the number of cases notified for the preceding quarter. Catarrhal fever was responsible for 1,567 of the total admissions.

Ships and shore stations reporting the largest number of cases were as follows:

	July	August	September	Total
Naval training station, Norfolk, Va.....	55	80	56	191
Naval training station, San Diego, Calif.....	66	75	43	184
Marine Barracks, Quantico, Va.....	41	51	24	116
Naval air station, Pensacola, Fla.....	17	37	21	75
Naval training station, Newport, R. I.....	23	19	25	67
Naval Academy, Annapolis, Md. (midshipmen).....	10	24	15	49
U. S. S. <i>Saratoga</i>	5	6	23	34
Regimental hospital, Fourth Marines, Shanghai, China.....	9	5	19	33
U. S. S. <i>Henderson</i>	6	13	12	31
Fleet air base, Pearl Harbor, Hawaii.....	4	6	20	30
U. S. S. <i>Tennessee</i>	9	12	9	30

Forty-seven cases of mumps occurred at the naval training station, Norfolk, Va. The annual venereal disease rate for the third quarter was 49 per 1,000 as compared with 75 for the corresponding quarter of 1935 and 42, the rate for the previous quarter. Single cases of chickenpox were reported by the U. S. S. *Maryland*, U. S. S. *Pennsylvania*, and the marine detachment, American Embassy, Peiping, China. One case of poliomyelitis, anterior, acute, was admitted to the sick list on the U. S. S. *J. D. Edwards*, and transferred to the United States Naval Hospital, Canacao, P. I. The patient, an ensign, with 7 years' service, was admitted on August 28 complaining of pains in the abdomen, general nervousness, and peculiar sensation over the entire body. On September 1 the patient developed a flaccid paralysis of both legs and a paresis of left arm, with absent reflexes, and retention of sensation. A few hours later both arms and the respiratory muscles became paralyzed. Artificial respiration resorted to on September 2. Death occurred on September 4, due to the extension of the infection to the bulbar centers.

The U. S. S. *Mississippi* reported one case of scarlet fever during the quarter.

Cerebrospinal fever and meningitis, cerebrospinal.—There were seven cases of cerebrospinal fever and four cases of meningitis, cerebrospinal, acute, reported during July, August, and September 1936, as follows:

CEREBROSPINAL FEVER

Rate	Age	Place of original admission	Date of admission	Length of service	Disposition
Seaman (1st class).....	23	U. S. S. <i>Salt Lake City</i>	July 14, 1936	2 years 6 months.....	Died, July 20, 1936.
Do.....	26	do.....	July 27, 1936	5 years 3 months.....	Duty, Nov. 27, 1936.
Machinist's mate (2d class).....	29	U. S. S. <i>Idaho</i>	Aug. 13, 1936	11 years 6 months.....	Died, Aug. 16, 1936.
Fireman (1st class).....	21	U. S. S. <i>Detroit</i>	Aug. 29, 1936	2 years 11 months.....	Still on list.
Mess attendant (3d class).....	22	Naval training station, Norfolk, Va.	Aug. 31, 1936	2 months.....	Duty, Dec. 4, 1936.
Apprentice seaman.....	19	do.....	Sept. 21, 1936	do.....	Died, Oct. 13, 1936.
Fireman (1st class).....	20	U. S. S. <i>Nevada</i>	Sept. 28, 1936	3 years.....	Duty, Nov. 3, 1936.

MENINGITIS, CEREBROSPINAL, ACUTE

Rate	Age	Place of original admission	Date of admission	Length of service	Disposition
Corporal.....	33	Marine Barracks, Quantico, Va.	July 28, 1936	2 years 6 months..	Died, July 30, 1936.
Private.....	28	Fourth Marines, Shanghai, China.	Aug. 17, 1936	1 year 11 months..	Duty, Oct. 19, 1936.
Seaman (2d class)...	19	U. S. S. <i>Vestal</i>	Aug. 18, 1936	11 months.....	Died, Aug. 21, 1936.
Ship's cook (3d class).	27	U. S. S. <i>Chester</i>	Sept. 29, 1936	4 years 2 months..	Duty, Oct. 22, 1936.

Typhoid fever and paratyphoid fever.—A private, Marine Corps, 19 years of age, with 12 days' service, was admitted to the Naval Hospital, Parris Island, S. C., on July 31, 1936, with a very severe case of typhoid fever. The patient died on August 9, 1936, and the contributory cause of death was recorded as myocarditis, acute. Autopsy showed "typical enlargement of mesenteric lymph nodes, greatly enlarged spleen, and terminal ileum and beginning colon show numerous hyperplastic, elevated, firm, oval, lesions which on removal of mucous membrane show a reddened base. Long axis of lesions is parallel with gut. Spleen is about 3 times normal size and friable. Mesenteric nodes are much enlarged and firm. No hemorrhage or perforation."

Infection was held to have existed prior to enlistment in the Marine Corps, since he arrived on Parris Island on July 30, 1936, as a recruit.

He gave history of typhoid vaccination 2 to 3 years prior to enlistment.

An officer with 27 years' service was admitted to the sick list on board the U. S. S. *Luzon* on August 11, 1936, with paratyphoid fever (A). Three complete courses of typhoid prophylaxis had been administered—one in March 1912, one in August 1916, and one in October 1921.

Summary of morbidity in the United States Navy for the quarter ended Sept. 30, 1936

Average strength.....	Forces afloat, 78,948		Forces ashore, 45,238		Entire Navy, 124,186	
	Admissions	Rate per 1,000	Admissions	Rate per 1,000	Admissions	Rate per 1,000
All causes.....	7,044	356.89	5,492	485.61	12,536	403.78
Disease only.....	5,737	290.67	4,705	416.02	10,442	336.33
Injuries.....	1,301	65.92	570	50.40	1,871	60.26
Poisonings.....	6	0.30	217	19.19	223	7.18
Communicable diseases transmissible by oral and nasal discharges (class VIII):						
(A).....	416	21.08	323	28.56	739	23.80
(B).....	1,383	70.07	1,356	119.90	2,739	88.22
Venereal diseases.....	1,088	55.12	434	38.87	1,522	49.02

Deaths reported, entire Navy, during the quarter ended Sept. 30, 1936

CAUSE—DISEASE

Primary	Secondary or contributory	Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....	.....	9,717	2,309	94,232	1,327	16,226	375	124,186
Aplastic anemia.....	Dilatation, cardiac, acute.....	.....	.....	1	.....	.....	.....	1
Appendicitis, acute.....	Peritonitis, general, acute.....	.....	.....	1	.....	.....	.....	1
Do.....	Septicemia.....	.....	.....	1	.....	.....	.....	1
Appendicitis, chronic.....	Peritonitis, general, acute.....	.....	.....	1	.....	1	.....	2
Carcinoma, rectum and bladder.....	None.....	.....	.....	.....	.....	1	.....	1
Cerebrospinal fever.....	do.....	.....	.....	1	.....	.....	.....	1
Do.....	Alcoholism, acute.....	.....	.....	1	.....	.....	.....	1
Dilatation, cardiac, acute.....	None.....	1	.....	.....	.....	.....	.....	1
Encephalitis, acute.....	do.....	.....	.....	1	.....	.....	.....	1
Endocarditis, acute ulcerative (malignant).....	Dilatation, cardiac, acute.....	.....	.....	1	.....	.....	.....	1
Furunculosis.....	Septicemia.....	.....	.....	1	.....	1	.....	2
Hemorrhage, cerebral.....	Arterial hypertension.....	.....	.....	1	.....	.....	.....	1
Hemorrhage, subdural.....	Pachymeningitis, cerebral.....	.....	.....	.....	.....	1	.....	1
Leukemia.....	Hemorrhage, intestinal.....	.....	.....	1	.....	.....	.....	1
Meningitis, cerebrospinal, acute.....	None.....	.....	.....	1	.....	1	.....	2
Myocarditis, chronic.....	do.....	.....	.....	1	.....	.....	.....	1
Do.....	Nephritis, chronic.....	.....	.....	.....	.....	1	.....	1
Myocarditis, acute.....	Alcoholism, acute.....	.....	.....	1	.....	.....	.....	1
Nephritis, chronic.....	Arterial hypertension.....	1	.....	.....	.....	.....	.....	1
Pneumonia, broncho.....	Arteriosclerosis, general.....	.....	.....	.....	.....	1	.....	1
Pneumonia, lobar.....	None.....	.....	.....	1	.....	.....	.....	1
Do.....	Dilatation, stomach, acute.....	.....	.....	1	.....	.....	.....	1
Do.....	Pleurisy, suppurative.....	.....	.....	1	.....	.....	.....	1
Do.....	Septicemia.....	.....	.....	1	.....	.....	.....	1
Polioomyelitis, anterior, acute.....	None.....	1	.....	.....	.....	.....	.....	1
Sarcoma, neck.....	Hemorrhage, stomach.....	.....	.....	1	.....	.....	.....	1
Sarcoma, thigh.....	Peritonitis, general, acute.....	.....	.....	1	.....	.....	.....	1
Septic sore throat.....	Septicemia.....	.....	.....	1	.....	.....	.....	1
Tonsillitis, acute.....	Pneumonia, lobar.....	.....	.....	1	.....	.....	.....	1
Typhoid fever.....	Myocarditis, acute.....	.....	.....	.....	.....	1	.....	1
Do.....	Peritonitis, general, acute.....	.....	.....	1	.....	.....	.....	1
Thrombosis, coronary.....	None.....	1	.....	1	.....	.....	.....	2
Tuberculosis, pulmonary, chronic.....	do.....	1	.....	2	.....	1	.....	4
Tuberculosis, pulmonary, chronic.....	Pneumothorax.....	.....	.....	1	.....	.....	.....	1
Tuberculosis, pulmonary, acute general miliary.....	None.....	.....	.....	1	.....	.....	.....	1
Total for disease.....	.....	5	.....	28	.....	9	.....	42
INJURIES AND POISONINGS								
Crush, chest.....	Fracture, simple, skull.....	.....	.....	1	.....	.....	.....	1
Drowning.....	None.....	2	.....	5	.....	1	.....	8
Electric shock, injury from.....	do.....	.....	.....	1	.....	.....	.....	1
Fracture:	.....	.....	.....	.....	.....	.....	.....	.....
Compound, frontal.....	do.....	.....	.....	1	.....	.....	.....	1
Do.....	Abscess, brain.....	.....	.....	1	.....	.....	.....	1
Compound, skull.....	None.....	.....	.....	1	.....	2	.....	3
Do.....	Hemorrhage, subdural.....	.....	.....	1	.....	.....	.....	1
Compound, temporal.....	do.....	.....	.....	.....	.....	1	.....	1
Do.....	Intracranial injury.....	.....	.....	1	.....	.....	.....	1
Simple, ribs.....	Hemorrhage, traumatic, pulmonary.....	.....	.....	1	.....	.....	.....	1
Simple, skull.....	None.....	.....	.....	2	.....	.....	.....	2
Injuries, multiple, extreme.....	do.....	4	.....	14	.....	.....	.....	18
Intracranial injury.....	do.....	.....	.....	2	.....	.....	.....	2
Intraspinal injury.....	Myelitis, transverse.....	1	.....	.....	.....	.....	.....	1

Deaths reported, entire Navy, during the quarter ended Sept. 30, 1936—Contd.

Primary	Secondary or contributory	Navy			Marine Corps		Nurse Corps	Total
		Offi-cers	Mid-ship-men	Men	Offi-cers	Men		
Fracture—Continued.								
Wound, gunshot, head.	None	1		1				2
Do.	Psychosis, unclassified.					1		1
Wound, incised, neck.	None			1				1
Poisonings:								
Arsenic	do.			1				1
Barbiturates	Alcoholism, acute			1				1
Pheno-barbital	Pneumonia, broncho			1				1
Carbon monoxide	None			1				1
Sodium fluoride	do.	1						1
Total for injuries and poisonings.		9		37		5		51
Grand total		14		65		14		93
Annual death rate per 1,000:								
All causes		5.76		2.76		3.45		3.00
Disease only		2.06		1.19		2.22		1.36
Drowning		.82		.21		.25		.26
Poisonings		.41		.17				.16
Other injuries		2.47		1.19		.99		1.22

ADMISSIONS FOR INJURIES AND POISONINGS, THIRD QUARTER, 1936

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the third quarter, 1936, is based upon all form F cards covering admission in those months which have reached the Bureau:

	Admissions, July, August, and September 1936	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1935
Injuries:			
Connected with work or drill	668	2,152	2,592
Occurring within command but not associated with work	621	2,000	1,709
Incurred on leave or liberty or while absent without leave	582	1,875	1,651
All injuries	1,871	6,027	5,952
Poisonings:			
Industrial poisoning	2	6	17
Occurring within command but not connected with work	218	702	43
Associated with leave, liberty, or absence without leave	3	10	19
Poisonings, all forms	223	718	79
Total, injuries and poisonings	2,094	6,745	6,030

Percentage relationships

	Occurring within command				Occurring outside command—leave, liberty, or A. W. O. L.	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	July, August, and September 1936	Year, 1935	July, August, and September 1936	Year, 1935	July, August, and September 1936	Year, 1935
Percent of all injuries.....	35.7	43.6	33.2	28.7	31.1	27.7
Percent of all poisonings.....	0.9	21.1	97.8	54.4	1.3	24.4
Percent of total admissions, injury and poisoning titles..	32.0	43.3	40.1	29.0	27.9	27.7

NOTE.—Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism", as the case may be. Such cases are not included in the above figures. There were no cases during the third quarter of 1936 worthy of notice from the standpoint of accident prevention.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following statistics were taken from sanitary reports submitted by naval training stations:

July, August, and September 1936	U. S. Naval Training Station			
	Norfolk, Va.	Newport, R. I.	Great Lakes, Ill.	San Diego, Calif.
Recruits received during the period.....	1,277	700	745	1,237
Recruits appearing before board of medical survey.....	5	0	4	0
Recruits recommended for discharge from the service.....	5	0	4	0
Recruits discharged by reason of medical survey.....	6	0	1	0
Recruits held over pending further observation.....	0	0	0	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment..	18	32	101	25

The following table was prepared from reports of medical surveys in which disabilities or disease causing the surveys were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Absence, acquired, teeth.....	1	Hernia, inguinal.....	2
Adhesions, abdominal.....	1	Hernia, recurrent, after operation.....	1
Ankylosis, terminal phalanx, right index finger.....	1	Loose body in joint, left knee.....	1
Arthritis, chronic, right knee and ankle.....	1	Malformation, congenital, undescended testicle.....	1
Cardiac disorder, functional.....	1	Malocclusion, teeth.....	1
Caries, teeth.....	4	Narcolepsy.....	1
Constitutional psychopathic inferiority, without psychosis.....	2	Otitis, media, chronic.....	3
Constitutional psychopathic state, emotional instability.....	1	Otosclerosis.....	1
Constitutional psychopathic state, inadequate personality.....	3	Paralysis, nerve, median and ulnar.....	1
Deafness, unilateral.....	2	Psychoneurosis, neurasthenia.....	2
Defective physical development.....	2	Pyorrhea alveolaris.....	1
Deformity, acquired, elbow.....	1	Retinitis, right eye.....	1
Deformity, acquired, knee.....	2	Strabismus.....	1
Deformity, acquired, toes.....	1	Synovitis, chronic, right knee.....	1
Dementia praecox.....	2	Syphilis.....	3
Epilepsy.....	3	Union of fracture, faulty.....	1
Flat foot.....	9	Valvular heart disease, aortic insufficiency.....	1
Fracture, simple.....	1	Valvular heart disease, combined lesions, aortic and mitral.....	1
Glycosuria.....	1	Valvular heart disease, mitral insufficiency.....	1
Hammer-toe.....	1	Valvular heart disease, mitral stenosis.....	1
Hay fever.....	1	Varicose veins.....	2

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VOLUME XXXV

JULY 1937

NUMBER 3

United States Naval Medical Bulletin

PUBLISHED *for the* INFORMATION OF
MEDICAL DEPARTMENT *of the* NAVY



THE MISSION OF THE MEDICAL CORPS OF THE NAVY

•
**TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**

Issued Quarterly by the Bureau of Medicine and Surgery
Washington, D. C.

VOL. XXXV

JULY 1937

No. 3

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED QUARTERLY FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY



Issued by
THE BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT



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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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JUL 15 1937

TABLE OF CONTENTS

	Page
PREFACE.....	v
NOTICE TO SERVICE CONTRIBUTORS.....	vi
SPECIAL ARTICLES:	
SEASICKNESS.	
By Lincoln Humphreys, Lieutenant Commander, Medical Corps, United States Navy.....	293
DEMENTIA PUGILISTICA.	
By J. A. Millsbaugh, Lieutenant, Medical Corps, United States Navy.....	297
LIQUID INSECTICIDES, REPORT OF COMPARATIVE STUDY OF.	
By F. S. Johnson, Commander, Medical Corps, United States Navy, and Arthur G. Vallee, Pharmacist's Mate, First Class, United States Navy.....	303
SOME DISEASES OF THE PERIPHERAL ARTERIES.	
By Edgar V. Allen, M. D., Division of Medicine, The Mayo Clinic, and Irvin L. Norman, Lieutenant, Medical Corps, United States Navy.....	309
A REVIEW OF TRACHOMA.	
By O. W. Cole, Lieutenant, Medical Corps, United States Navy..	322
CLINICAL NOTES:	
STAPHYLOCOCCUS SPINAL LEPTOMENINGITIS.	
By E. M. Wade, Lieutenant, junior grade, Medical Corps, United States Navy, and F. H. O'Neil, First Lieutenant, Medical Re- serve Corps, United States Army.....	329
LYMPHOPATHIA VENEREUM.	
By W. S. Rizk, Lieutenant, junior grade, Medical Corps, United States Navy.....	331
PNEUMOCOCCUS SEPTICEMIA COMPLICATING PERITONSILLAR ABSCESS WITH SPECIFIC SERUM THERAPY.	
By James J. V. Cammisa, Lieutenant, junior grade, Medical Corps, United States Navy.....	339
IMMOBILIZATION OF FRACTURE OF THE CLAVICLE BY MEANS OF PLASTER OF PARIS.	
By Robert E. Baker, Lieutenant, Medical Corps, United States Navy.....	343
REPORT OF AN UNUSUAL CASE OF ABNORMAL DENTITION.	
By Charles F. Hoyt, Lieutenant, Medical Corps, United States Navy.....	344
NAVAL RESERVE.....	347
NOTES AND COMMENTS:	
The Tenth Surgeon General, United States Navy—Articles of Special Merit Published in 1936—Use of Glycerine in Medicine—Annual Meeting of the Association of Military Surgeons—Precipitin Test for Trichinosis.....	349

III:

BOOK NOTICES:	Page
William Withering, Roddis—Dispensatory of the United States— Autopsy Diagnosis and Technique, Saphir—Diseases of the Heart and Arteries, Herrmann—Management of Obstetric Difficulties, Titus—Prescription Writing, Solomon—Diseases of Nose and Throat, Imperatori.....	353
PREVENTIVE MEDICINE:	
SANITARY REPORT OF SWAINS ISLAND WITH HISTORICAL NOTE. By C. S. Stephenson, Commander, Medical Corps, United States Navy.....	357
FOOD POISONING.....	365
HEALTH OF THE NAVY—STATISTICS.....	367

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, and reports from various sources, notes, and comments on topics of medical interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

P. S. ROSSITER,
Surgeon General, United States Navy.

NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received at least 3 months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

U. S. NAVAL MEDICAL BULLETIN

VOL. XXXV

JULY 1937

No. 3

SPECIAL ARTICLES

SEASICKNESS¹

By LINCOLN HUMPHREYS, Lieutenant Commander, Medical Corps, United States Navy

Naval Hygiene by Rear Admiral James C. Pryor, Medical Corps, United States Navy, defines seasickness as a condition caused by the motion of vessels at sea and aggravated by disagreeable odors, which affects many individuals. Every person who is in the habit of taking ocean voyages has suffered or will suffer from this condition. Having been the medical officer of six ships, including three Navy transports, I have not had this condition develop on the larger ships, but was most affected when I took a voyage on a seagoing tug, the U. S. S. *Ontario*, from American Samoa to Auckland, New Zealand. I have had to treat men and women with this condition, but to treat a child was a rarity. I believe this is due to the fact that children in their spirit of play are apt to forget their temporary environment.

ETIOLOGY

1. Visual.
2. Auditory or labyrinthine.
3. Splanchnic.
4. Olfactory.
5. Psychic.

Visual.—The human eye gets very tired when you are walking on the decks of a ship and looking at the wave crests, which are at varying heights due to wind, and with the sunlight reflecting from them there is a great strain on the retinae resulting in disturbance of retinal images. The glare on a clear day is unusually bright and with the rolling of the ship there results in susceptible individuals a generalized headache, followed by reflex nausea and vomiting if dark glasses or some other means are not taken to diminish the glare.

Auditory or labyrinthine.—The observations by James that deaf mutes did not suffer from seasickness, and the profound studies by Barany and others during the late war showed that one explanation rested in disturbance of the endolymph of the semicircular canals. When the ship is rolling, pitching or otherwise doing a vermicular

¹ This paper was read at the Medico-Military Symposium held at the Mayo Clinic, Rochester, Minn. on the 5th of October 1936.

motion in a heavy seaway, the ability to maintain one's balance enough to walk is enough to agitate any endolymph to the point where reflex vomiting naturally follows.

Splanchnic.—The pitching of a ship when it ploughs over the crest of a mountainous wave only to drop suddenly into a trough between it and the next wave, and repeats this process sometimes for as many as 4 days, minute in and minute out, hour in and hour out, produces the same effect as if one were in a rapidly descending elevator had suddenly stopped, with its consequent jolting upward of the viscera in the abdominal cavity. This is the process that goes on in a passenger on board ship when rough weather is encountered, until reflex vomiting occurs.

Olfactory.—In compartmental spaces on board ship, while ventilation is satisfactory during good weather on account of the plenum and exhaust systems, it is a different matter during heavy weather, for everything has to be secured or battened down so that due to the lesser number of intake ventilators the air content is not changed often enough. Odors of the ship's galley become noticeable and shortly after breakfast you almost know what you are going to have for lunch. Then there are the various odors due to hempen ropes, materials used to calk the ship, those from the heads or water closets. This added to the normal CO₂ output and body emanations constitute an assault on the olfactory apparatus until it takes quite a constitution to withstand becoming nauseated from this factor alone besides the cumulative effect of the other factors.

Psychic.—There are some people who just know they are going to be seasick. These are the same people who get train sick, sick from riding in an automobile, etc. Their psychomotor system is so delicately balanced that any unusual motion or vibration which is prolonged sets up an imbalance. When the anchor comes up they usually get flat on their backs and when the ship is finally moored to the dock they appear on deck again apparently none the worse for wear.

SYMPTOMS

With all the factors described under etiology working on an individual the cumulative effects produce nausea as the primary symptom. The patient has a greenish hue, he is as sick as if he had a case of food poisoning.

The nausea is intense and is followed in time by explosive vomiting. After the contents of the stomach are lost there is intense retching, which in some cases observed had a slight tinge of blood in the mucus that was vomited. Temporary nystagmus has even been observed. The individual is so sick that he may have a fear of impending death. He may show the effects of dehydration because he fears to take any liquids. The mention, sight, or odor of food may cause further attacks of nausea and vomiting in some cases. A mild or severe

depression may ensue. The writer has never seen a death result from sea sickness in the naval service. The majority of cases show marked improvement on the third day, and then if care is exercised in the kind and amount of food there are no recurrences.

PROPHYLAXIS

Aged and debilitated persons should not take prolonged voyages, and a physical examination should be made before they take a sea voyage of any sort. The physical exertion incident to violent emesis can and probably has furnished the final chapter in severe myocarditis or in an arterial hypertension with previous angina pectoris attacks.

The day preceding commencement of a voyage the bowels should be thoroughly emptied by a purge, no greasy or highly spiced foods should be eaten and absolutely no alcoholic overindulgence.

The day prior to sailing, the prospective passenger should inspect the ship, learn how to walk through the narrow passageways without barking his shins on the compartmental coaming, learn how to walk up and down a ship's ladder without falling to the deck below, go past the galley and let his nose become accustomed to the steam boiler cooking smells, and visit the toilet spaces and wash rooms to acquaint himself with the odor from the hawse pipes and to the cramped space itself.

Studiously avoid the farewell banquet, the all-night poker party, or other nocturnal diversions which might cause loss of sleep.

Three hours before the time the ship sails he should be on board, or better still spend the night before on board and get a good night's sleep; in other words, get used to living on board so that when the main engines are set in motion and vibration starts he will be accustomed to his stateroom.

Dark glasses or tinted glasses should be worn if the retinae are at all sensitive to light, certainly to avoid glare of the dancing waves in the sunlight.

If any of his fellow passengers start a conversation about how sea sick they were on their last voyage, or talk about the virtues of this or that remedy he should excuse himself and seek some other portion of the ship. Eat no rich foods the first day at sea or else you will hear from them later; don't indulge in too many liquids in order that the stomach may become used to the churning and pitching, yes and even writhing, of the ship. But, above all, eat something during the day. A suitable portion of the deck is amidships, out of the glare of the sun, with your back to the rail, in a comfortable steamer chair.

TREATMENT

Prevention and treatment are difficult. Those rules stated above will prevent many cases, and have prevented them during many miles of ocean travel on ships to which I have been attached. Eighty-nine

thousand miles of ocean travel were completed by me in 1919 and I stopped tallying after that time.

Most of the proprietary remedies have chlorbutanol (chloretone) as a basis, but it acts as a depressant like a bromide would and I have not felt like depressing an already depressed individual. Atropine sulphate by hypodermic has been recommended, sodium nitrite 3 to 5 grains every 2 hours until relief is experienced but if the latter treatment is given a careful check on blood pressure must be made. The wearing of an abdominal binder to keep the abdomen warm has helped some cases.

Chairs which yield to motion in two directions have been recommended. Strychnine, one-thirtieth grain three times a day for 2 days is thought to be of value in toning the muscular system provided it is not otherwise contra-indicated.

You will not find a description of sea sickness or treatment of the same in ordinary text books of medicine except in *Diseases of the Nervous System* by Jelliffe and White and these remarks on treatment which have been mentioned are found in *Tropical Medicine and Naval Hygiene* by Rear Admirals E. R. Stitt and J. C. Pryor, Medical Corps, United States Navy.

In 1929 while attached to a transport which carried women and children I began using tomato juice as an adjunct in the treatment of this condition. The liquids combatted the dehydration, addition of salt to taste replaced body salines. The tomato juice was poured over cracked ice and sipped gradually, and a few saltines eaten at the time. This was used three times a day the first day and until noon of the second. Proper attention was paid to the emunctories. The stateroom was provided with fans to agitate the air and supplement the ventilation. All soiled linen and towels were removed immediately.

The patients slept with their feet toward the bow of the ship to minimize the effect of the pitching.

Cracked ice was given ad libitum. By noon of the second day small amounts of fruit juice poured over cracked ice was served. First grapefruit juice unsweetened was used, then pear juice and small amounts of pineapple juice. By evening of the second day the patients were usually able to take clear broths, especially beef and chicken served very hot.

The third day soft diet was readily taken in most instances. The only patient who did not respond to this treatment was a woman who finally confessed on the fifth day that she was 3 months pregnant. This had been suspected but she had previously denied it. All factors considered in prophylaxis were applied to all cases. Physical examinations were made of cases appearing seriously ill before any treatment was undertaken and pertinent points in the history were evaluated.

CONCLUSION

It is believed that seasickness should be included in general text books under "Diseases due to physical agents", such as heat exhaustion, caisson disease, heat stroke, effects of electricity and mountain sickness, not from the standpoint of it causing fatalities but to acquaint the civilian medical profession with the etiology, prophylaxis, and treatment of this condition in order that they may in turn advise their patients when they are consulted about prospective sea voyages.

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DEMENTIA PUGILISTICA

By J. A. MILLSPAUGH, Lieutenant, Medical Corps, United States Navy

"Punch drunk" is a colorful descriptive term, long in lay use, and scarcely requiring elucidation. Various intended synonymous professional terms have been employed, among them, concussion of the brain, post traumatic neurosis or psychosis, traumatic encephalitis and traumatic encephalopathy. None of these is distinctive. It occurred to me that the title proposed at once rules out related but nevertheless distinct traumatic brain injuries and supplies a distinctive term for a definite condition.

"Punch drunk" implies a derisive connotation, especially among collegiates; even the hardened professional resents the implication. The most typical examples of this disorder are usually found among the less expert boxers, particularly as concerns defensive ingenuity, nevertheless those capable of absorbing inordinate punishment.

The objections to such a definite term are principally two: Is each occupational calling to receive a name for disability pertinent thereto, e. g. aeroneurosis for a neurosis common to aviators? This would perhaps unnecessarily encumber the nosological nomenclature. The mental unbalance more commonly encountered among pugilists is also observed among other sports representatives who sustain considerable head trauma.

I have talked with several naval medical officers concerning the possibility of such an entity as punch drunk. Three of them have had post-graduate work and considerable experience in psychiatry. But for one qualified exception they agree that there are definite neurological, intellectual, and personality changes presented by typical fighters, particularly those of the older order who fought more often,

certainly longer and perhaps harder. Specific cases were pointed out to justify these conclusions.

DaCosta writes:

A blow over the solar plexus, upon the point of the chin, upon the testicle (a not infrequent foul blow is boxing) on the larynx, or over the heart may cause death by inhibition. Inhibition is defined as probably reflex stimulation of pneumogastric nuclei and arrest of cardiac action.

Friedman's complex or vasomotor syndrome (a train or cycle of symptoms due to a progressive subacute encephalitis of traumatic origin and comprising fullness in the head, cephalgia vertigo, irritability, insomnia, increased fatiguability, and memory defects) may be applied to some fighters almost as though they were the subjects, study of whom, dictated this group of symptoms.

Over 50 percent of severe head injuries are said to entail residual effects (13).

A quotation from the J. A. M. A. (10) relates "Trauma to the brain may attack the basal ganglions and produce the syndrome of paralysis agitans."

Martland (1) lists 23 fighters said by one promotor to be punch drunk; at the time of his report (1928) four of these were known to be in asylums.

Autopsy findings reported by those doing medico-legal work indicate that the results of trauma vary thus: That due to gross accidental brain injuries reveal laceration or destruction with macroscopic hemorrhage while those due to repeated or less severe trauma to the central nervous system are characterized by microscopic ring hemorrhages.

Parker (3), commenting upon a report of a case of a punch drunk stated:

No specific nervous syndrome appeared, such as Parkinsons' disease, but rather a medley of scattered and incomplete lesions of the brain.

Jokl and Guttman (4) believe that a definite dementia due to cerebral trauma incident to pugilism affects fighters.

In the ring no anatomical region is inviolate despite the Marquis of Queensberry rules. Since a knockout is the most decisive outcome of contest vulnerable points are sites of election for attack. A knockout is a punch that renders a man unable to face his opponent for ten seconds or longer. The majority of knockout blows are directed to one of four points, the chin, the epigastrium, beneath either ear, and over the heart. The head, particularly the jaw, from which point concussion is readily transmitted to the base of the brain and vital cerebral centers, as well as the solar plexus and cardiac area, are sites of concentration for opponents. Various ruses are resorted to that fire may be drawn from an individual vulnerability.

It is significant that various athletic rulings and State regulations permit no greater discrepancy in opponents' weights than 4 to a maxi-

mum of 10 pounds, except for those over 175 pounds. This measure obviates a too great advantage in brawn. A further ruling requires contestants to be examined by a qualified physician. It is presumed that the examinee shall be disqualified unless his physique and stamina are sufficiently adamant to withstand severe corporeal punishment. In view of probable contingencies the attendance of a certified physician during bouts is provided.

When available the medical officer in the United States Navy is required to examine boxers and attend bouts. The rules applied by the naval service are those of the National Collegiate Athletic Association.

The National Boxing Association rules and the New York State Athletic Commission rules are almost identical:

SEC. 3. Officials.—Shall consist of a referee, two (2) judges, a timekeeper, a director of bouts, an announcer, and a physician.

The club physician.—Within 6 hours of entering the ring each contestant must be given a thorough medical examination by a physician who has been licensed to practice not less than 3 years previously. He shall certify to the director of bouts in writing over his signature that the contestants are in good physical condition to engage in such contest. And said physician shall be in attendance during the contest prepared to deal with any emergency which may arise.

National Collegiate Athletic Association rules for boxing:

RULE 6. OFFICIALS

SECTION 1. The Officials shall be a referee, two judges, two timekeepers, and one medical officer.

RULE 7. MEDICAL EXAMINATION, WEIGHING-IN, AND DRAWING

SECTION 1. Contestants shall present themselves promptly to the medical officer at the time appointed for medical examination and weighing-in.

NOTE.—Weighing-in shall take place within 4 hours of bout.

Patently, the etiology of dementia pugilistica is trauma, usually repeated frequently and varying from a comparatively insignificant abrasion, contusion or laceration to compound fracture, brain concussion, loss of consciousness, shock, coma, and death.

An altered visage and mind comprise a physical-psychic syndrome that characterizes many veterans, amateur, semiprofessional, and professional prize fighters, that is as authentic in its manifestations as are some of the more classical examples.

Othematoma resulting in the stiff, shriveled, thickened convolutions of the pinnae; the depressed, flattened, displaced nose and the hypertrophied, multiple scarred superciliary arches compose a physiognomical triad as characteristic as is Hutchinson's.

Many fighters have a dyslalia occasioned by an alteration of both primary and secondary speech channels. Traumatized larynx, fractured nose and teeth affect the voice which may be hoarse, rasping, husky, coarse, or thick. Exaggeratedly modified breathing habits

intended to clear the upper respiratory passages of blood, mucus, and saliva becomes eventually a characteristic habit. A spluttering enunciation is effected. The voice is also probably affected by the psychic attitude and association and is in some degree characterized by the term "belligerent" or "vindictive."

The metacarpophalangeal articulations are usually hypertrophied.

Various mannerisms such as scowling, snorting, blowing, grimacing, crouching, and squaring off are commonly witnessed.

Sounds similar in tone to the ring bell illicit a pose in various characteristic defensive or offensive attitudes which are excellent examples of conditioned reflexes.

That confusion is a frequent symptom manifested by boxers requires but little observation. Following a particularly active foray opponents often evince a transient directional disorientation requiring escortation to the proper corner. Immediately following recovery from a knockout, daze or stupor is common. "Where is he?" the defeated inquires simulating aggressive tactics.

Fighters usually harbor a mild delusionary trend with magnification of their former prowess by a system of comparison favorable to the individual's record at the expense of better known more fortunate exponents with whom they may have associated in some capacity such as sparring partner.

Dysbasia is evidenced by swaying, shuffling, staggering, and later a propulsive or festinating gait. The expression "walking on his heels" is frequently applied to fighters.

Muscular dysergia or dystonia is manifested by leg drag, and a transient paralysis with clouding of consciousness while the fighter instinctively carries on though so battered and befuddled that muscular coordination is insufficient to effectively raise the guard and the victim is mercilessly pummeled until the oblivion of the final count or the second's toss of the towel concedes defeat.

Periods of amnesia, sometimes almost complete, follow knockout punches affecting the head. That amnesia of some degree may be a consequence of severe beatings, even without the knockout, is attested by many who have suffered the experience.

One morning while awaiting a boat aboard a cruiser I was attracted by the unusual behavior of the officer of the deck. Judging by his boisterous activity (vocal, pantomime, and footwork) one might envisage him directing a deadly engagement, the outcome of which was by no means certain. Inquiry revealed he was a well-known athlete while at the Naval Academy. Over a year later I had occasion to see him burst into a room where five medical officers were temporarily assembled. He chose a seat on the windowsill, spouted forth concerning his ailment and abruptly departed in a dash. Upon his departure the doctors variously shook their heads, lightly smiled, regarded one another with questioning gaze and one murmured, "Punch drunk."

A previous top notch fighter was a patient in the encephalitic ward at the United States Naval Hospital, Great Lakes, Ill., in 1930-31. He presented a well-developed Parkinsonian syndrome. The Parkinsonian syndrome has been repeatedly reported in fighters. (1) (3)

I have known an ex-fighter to be considered as inebriated by ward mates when he had not a swallow of intoxicant over a long period. The heavy, mouthy "set" voice, jerky, sluggish movement together with the subjective symptoms of daze just short of mild vertigo, combined to produce this impression.

The *corpora striata*, *corona radiata*, and the basal ganglions are the central nervous system localizations particularly affected. The battle-scarred visage is probably a reliable index of the mental, neurological, intellectual, and personality changes to be anticipated.

Traumatic punctate cerebral hemorrhages, hydrostatic disequilibrium of the spinal fluid, cerebral edema, concussion injury to the cortical cells, cerebral vasomotor imbalance, reparative gliosis or degenerative lesions of the cerebral parenchyma, variation in the weight and therefore inertia between gray and white brain matter and tension transmission by nerves, blood vessels, and musculature comprise the actual or theoretic pathogenesis thus far proffered in explanation of the dementia of pugilists.

A number of courageous but inexperienced boxers are too severely and unnecessarily punished because thoughtless managers, trainers, or greedy seconds match them with opponents far out of their class in experience, condition, strength, or weight.

Quasi-professional fighters who normally follow other means of livelihood will occasionally sign for a bout attracted only by the financial reward which is not great. They are seldom in good condition but they are willing to take probable punishment to further their immediate financial status. Needless to note, hospitalization and consequent loss of regular work may more than offset their immediate remuneration.

Many a champion has risen to transient eminence over the bruised bodies and broken minds of other aspirants. It has been noted that some champions are spared the stigmata of the ring. Indeed, some escape the most and worse but few, if any, escape all the signs and symptoms.

When a man is obviously beaten, and "out on his feet" it is the duty of the attendant medical officer to advise termination of the bout in the interest of mental hygiene.

Why are fighters invariably associated with managers who in most instances conserve more gain than their charges, few of whom retain any considerable material resources? It might be objected that fighters as a class do not stand high mentally but certainly as high as many other groups who fare better in after years. Some fighters are puerile and are watched over by trainers much as a child is guided by

a strict governess. Most fighters are easy-going and though a taunt or a stinging rap may incite an angry retaliative flare, this irritative phase soon passes and the grudge return engagement exists more through the efforts of publicity than actual hatred.

Boxers are necessarily transients. Several who have been prominent are said to have arrived via the hobo route. Occasionally one sees an individual who would make an excellent specimen for detailed study but any prolonged contact except with those who may be shipmates or inmates of one of our larger hospitals is unlikely.

Again, repeated and frequent concussions, occasionally very severe, often undoubtedly associated with intracranial capillary hemorrhages are to say the least not conducive to stabilized mental equilibrium.

For a number of years the writer has been interested in boxing as a spectator. Many contacts occasioned by duty as examiner have afforded opportunity to observe fighters and their peculiarities. While no individual cases are presented in detail these observations are gleaned rather from reflection and form a more or less composite impression of many individuals who presented the various signs and symptoms delineated.

Tall tales and amusing anecdotes concerning the erratic behavior of fighters may be garnered wherever the coterie of the ring foregather; doubtless some of these are unnecessarily garnished. Nevertheless, it has been remarked "all exaggeration is based on facts."

SUMMARY

A new term is proposed for a condition long recognized but accorded little medical cognizance.

A physical-psyhic syndrone characterizing the condition is presented.

Boxing rules are reviewed and the intervention of medical officers is urged in some bouts in the interests of mental hygiene.

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LIQUID INSECTICIDES, REPORT OF COMPARATIVE STUDY ¹

By F. S. JOHNSON, Commander, Medical Corps, United States Navy, with the technical assistance of Arthur G. Vallee, Pharmacist's Mate first class, United States Navy

The use of pyrethrum flowers for insecticidal purposes appears to have originated in Persia. It was first introduced into Europe early in the nineteenth century. Since that time the Persian insect powder has been prepared from the flowers.

Pyrethrum is a section of the genus *Chrysanthemum*, family Compositae. The United States Department of Agriculture recognizes only three species of *Chrysanthemum* as being suitable for the manufacture of insect powder. These species are:

Chrysanthemum (Pyrethrum) *cinerariaefolium* (Treviranus) Boccone.

Chrysanthemum (Pyrethrum) *roseum*, Webb and Mohr.

Chrysanthemum *Marshalli* Ascherson (synonym, *Pyrethrum carneum* Marshall Bieberstein).

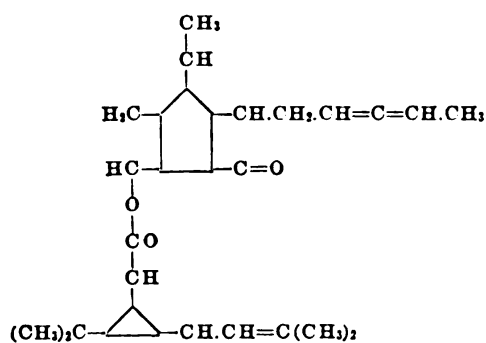
Pyrethrum cinerariaefolium is the only species of commercial importance, because the available quantities of the other two species are very small.

Until 1914 nearly all the pyrethrum used in this country was imported from Dalmatia. When this source of supply was cut off by the World War, Japan seized the market. Since 1928, *Chrysanthemum cinerariaefolium* has been cultivated for commercial purposes in Kenya. It grows well in Kenya, particularly at an elevation of 5,000 to 7,000 feet, and flowers throughout the year. Other countries, e. g., Dalmatia and Japan, have only a short season of growth.

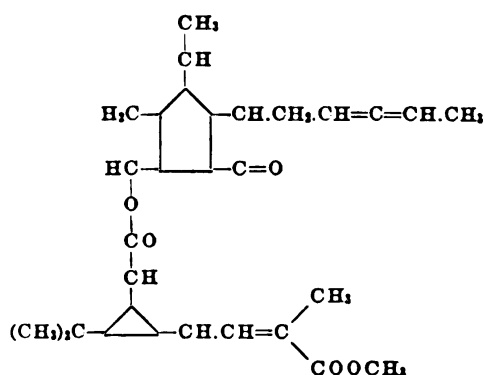
About 1919 in America, kerosene extracts of the flowers began to displace the powder for household use. There are now on the market a large number of proprietary insecticidal sprays containing the active principles of pyrethrum.

In 1924, Staudinger and Ruzicka (1) isolated the active principles from pyrethrum. These principles they called pyrethrin I and pyrethrin II. These pyrethrins are complex esters of *chrysanthemum* and reside in the seeds of the flowers. Because of the spatial arrangement of the atoms, the commercial production of synthetic pyrethrins is regarded as highly improbable. The graphic formulas of pyrethrins I and II are:

¹ From the laboratories of the U. S. Naval Medical School, Washington, D. C.



PYRETHRIN I



PYRETHRIN II

No satisfactory method of quantitatively estimating the pyrethrins was devised until Gnadinger and Corl (2) developed their method. The copper reduction method of Gnadinger and Corl determines the total pyrethrins. The pyrethrin I and pyrethrin II contents of the flowers are determined separately by the Seil method (3). In 1936, Ripert and Gaudin (4) showed that in direct contact with flies pyrethrin I is approximately two and a half times as toxic as pyrethrin II; on fish, the toxicity of pyrethrin II is about twice as great as that of pyrethrin I. It is obvious, therefore, that there may be some advantage in determining separately the percentage of pyrethrin I and pyrethrin II. However, since these two pyrethrins are usually present in definite proportions, a knowledge of the total pyrethrin content is sufficient for most purposes. Nevertheless, every assayed sample shows a higher pyrethrin content by the Seil acid method than by the Gnadinger-Corl copper reduction method. Therefore, purchasers of pyrethrum and pyrethrum products, who buy on a guaranteed pyrethrin content, should ascertain by which method the pyrethrin content has been determined.

Before the pyrethrins were identified, much work was done for the purposes of detecting the addition of powdered stems and daisies to pyrethrum powder. The Department of Agriculture determined stems in powdered pyrethrum by the following formula: $s = \frac{100(a-C)}{a-b}$,

in which s is the percentage of stems in the sample; a is the average percentage of nitrogen in the flowers; b is the average percentage of nitrogen in the stems; C is nitrogen content of the sample. In powdered samples, microscopic examination served to detect the addition of daisy flowers. Needless to say, there is no direct connection between pyrethrin content and these examinations.

When the first pyrethrum sprays were put on the market, about 1919, nothing was generally known about the nature and percentage of the active principles in the flowers. Since 1929 it has been learned that the percentage of pyrethrins in commercial flowers varies from 0.4 to 1.45 percent. The Kenya flowers show the highest content of

pyrethrins, and the Dalmatian flowers contain the least percentage. Flowers of acceptable grade should contain not less than 0.9 percent of pyrethrins. If these precautions are taken, by chemical assay, it is now possible to manufacture an insecticide having a definite pyrethrin content and toxicity. It is because so much pyrethrum available in the open market is inferior in pyrethrin content that so many liquid insecticides prepared from nonassayed pyrethrum produce unsatisfactory results.

There are now present in the market pyrethrum concentrates. The preparation of these concentrates is covered by patent. The best known of these concentrates is Pyrocode 20, which is manufactured by McLaughlin Gormley King Co., Minneapolis, Minn. Pyrocode 20 was for several years the only standardized pyrethrum extract on the market. Its manufacture is covered by United States Patent 1915662. It is guaranteed to contain 2 grams of pyrethrins per 100 cubic centimeters. Each gallon of this concentrate contains, therefore, the pyrethrins from 20 pounds of flowers assaying not less than 0.9 percent pyrethrins. When diluted with 19 parts of kerosene, the 20-1 concentrate yields a finished spray, each gallon of which contains the active principles of 1 pound of pyrethrum flowers of acceptable potency. Practically all insecticide manufacturers now prepare their finished pyrethrum sprays from pyrethrum concentrates.

Concentrates retain their strength practically indefinitely. It is necessary, however, to keep all pyrethrum products in tightly sealed tin or iron containers, or in amber glass. Standard strength insecticides lose strength when packed in blue or flint glass. Either ground or whole pyrethrum flowers lose pyrethrins by decomposition in storage. Antioxidants added to concentrated pyrethrum extracts inhibit decomposition.

It is generally considered that the pyrethrins from 1 pound of pyrethrum of acceptable grade, when contained in 1 gallon of kerosene, yield a satisfactory fly spray. For general use, however, it is highly desirable to increase the pyrethrin content much more than this. In order to obtain the maximum insecticidal property from pyrethrins, it becomes necessary to increase this concentration about fourfold. Surgeon Williams of the United States Public Health Service (5) found that the optimum strength of pyrethrum corresponds to 0.4 percent pyrethrins. He recommends (6) 5 cubic centimeters of this concentration of pyrethrins per 1,000 cubic feet of space, in preference to carboxide, for fumigation of airplanes.

The toxicity of some of the materials recommended for household sprays has not been thoroughly investigated, or at least reported in the literature. In the July issue of *Industrial and Engineering Chemistry*, pages 809-821, three articles were published by the United States Department of Agriculture indicating that derris and rotenone are much more toxic than hitherto supposed, especially when dissolved in

oil, and when taken into the body through the respiratory tract. Further work will no doubt be necessary to determine the exact toxicity of derris and rotenone, but it has been known for years by millers of derris that this material was very toxic to the men operating the mills. In the same way, the toxicity of benzophenone has not been thoroughly determined. Unfortunately, investigations on the toxicity of a given material must be extended over a number of years. In contrast, pyrethrum has been used for centuries and no authentic cases are known where human beings have been poisoned with it, with the exception of dermatitis which is found in rare cases where individuals have an allergy for pyrethrum.

The menace to public health of spray residues of lead, arsenic, fluorine, and other inorganic materials on fruits and vegetables demands that insecticides of the future be organic materials, which are more toxic to insects and less toxic to mammals than are inorganic materials. Such insecticides will be extracted from plants or synthesized from compounds derived from plant products. These synthetic compounds need not be so complex as rotenone and the pyrethrins, for many easily made products possess high insecticidal value. The field for research is immense and largely untouched.

A chemical which has been made available belongs to the class of compounds which are known as aliphatic thiocyanates (see United States Patent 1808893). No elements which are basically poisonous are involved. The organic chemical is B-butoxy, B'-thiocyanodiethyl ether. It is synthesized by Rohm & Haas Co., 222 West Washington Square, Philadelphia, Pa. It is marketed under the trade name of Lethane 384. The insecticidal strength of this synthetic chemical compares favorably to that of pyrethrum. Experiments indicate that it can advantageously substitute part of the pyrethrins (?) in sprays. This chemical provides an opportunity for enhancing the insecticidal property of a pyrethrum spray. The action of 5-percent Lethane 384 on bedbugs is really spectacular. It will stop a bedbug in its track and kill it instantly. Pure Lethane 384 sprayed on absorbent paper loses only 43 percent of its weight when exposed for 2 weeks; for this reason it is believed that moth sprays containing 5 percent of this chemical are preferable to many moth-proofing agents. Its sustained action will last several months. Under normal conditions, protection should be positive for furniture and stored clothes during at least one season. Woolen mills employ it for protecting their yarns. The chemical is very stable. It will retain its strength from year to year. It will not stain.

The Peet-Grady test (8) was developed in 1928 for evaluating the killing power of insecticides. Complete details of the method (9) can be found in the April 1932 issue of *Soap*, a magazine published by the McNair-Dorland Co., 254 West Thirty-first Street, New York City. It has been adopted as a tentative standard by the National Associa-

tion of Insecticide Manufacturers. The test equipment consists of a special chamber 6 feet on each side, into which a given number of flies are released. A definite quantity of the spray is then introduced quickly into the chamber through small holes in the side. After 10 minutes, the number of flies which have fallen to the floor are counted and recorded as the percentage of flies knocked down by the spray. These downed flies are then placed in a small cage and at the end of 24 hours the number of dead flies is taken as the percentage of final kill. The average household insecticide will give a knock-down of from 95 to 98 percent, whereas the final kill will average around 60 to 70 percent. The Peet-Grady method has obvious weaknesses which the insecticide association is studying with the idea of improvement. Many modifications have been proposed recently.

PROCEDURE OF INVESTIGATION

In the investigation of insecticides at this school it seemed desirable to use an ordinary stovepipe with an elbow, each arm of which was 1 foot long. Preliminary observations showed that with flies the results were quite similar to those obtained by the Peet-Grady method. Instead of flies, which are rather susceptible to sprays, the cockroach was selected as the test insect. Because of its heavy exo-skeleton, the cockroach provides a wider range for evaluating the potency of an insecticide. The cockroaches were placed in a wire cage, which was suspended in the upright arm of the stovepipe. Five cockroaches were placed in each cage, and four cages were used for each test. They were thus exposed to the effect of the mist from 5 cubic centimeters of liquid insecticide emitted from a DeVilbiss electric sprayer, type NC. The study involved tests on the sprays of reference in table I, which table also lists the percentages of kill. Lowell B. Kilgore, Ph. D., formerly of the United States Department of Agriculture, offered helpful suggestions in connection with these tests.

TABLE I

Per- cent	Solution	Percent kill
5	20-1 concentrate in petroleum distillate.....	0
6	do.....	0
8	do.....	30
10	do.....	55
15	do.....	80
20	do.....	100
5	Lethane 384 in petroleum distillate.....	30
4	Lethane 384 plus 2 percent 20-1 concentrate in petroleum distillate.....	30
4	Lethane 384 plus 4 percent 20-1 concentrate in petroleum distillate.....	30
5	Lethane 384 plus 5 percent 20-1 concentrate in petroleum distillate.....	40
5	Lethane 384 plus 8 percent 20-1 concentrate in petroleum distillate.....	60
6	Lethane 384 plus 6 percent 20-1 concentrate in petroleum distillate.....	60
7½	Lethane 384 plus 7½ percent 20-1 concentrate in petroleum distillate.....	70
5	Lethane 384 plus 15 percent 20-1 concentrate in petroleum distillate.....	100

DISCUSSION OF RESULTS

A mixture of 15 percent Pyroicide 20 and 5 percent Lethane 384 in refined kerosene yielded a consistent kill of 100 percent when used under conditions of test employed.

Lethane 384 is a standard concentration of 50 percent by volume of B-butoxy, B'-thiocyanodiethyl ether containing 3.47 to 3.53 grams of nitrogen per 100 cubic centimeters. The 20-1 pyrethrum concentrate, Pyroicide 20, contains 2 grams of pyrethrins per 100 cubic centimeters. It is apparent, therefore, that the concentrations of the ingredients employed corresponded to 0.3 percent pyrethrins (15 percent 20-1 pyrethrum concentrate) and 2.5 percent B-butoxy, B'-thiocyanodiethyl ether (5 percent Lethane 384). The lethal effect of the finished spray exceeded that which was obtainable from 0.4 percent of pyrethrins. Increasing the percentage of Lethane 384 much more than 5 percent produced an unpleasant odor. Also, since the price of Lethane 384 is about 28 percent greater than the price of pyrethrum concentrates, a further increase in the concentration of Lethane 384 would appreciably increase the cost of the finished spray.

Since table I indicates that either 5 percent Lethane 384 or 8 percent 20-1 pyrethrum concentrate has about the same lethal effect on cockroaches, it would seem logical to suspect that the aliphatic thiocyanate and pyrethrum flowers could be interchanged in a definite ratio of final concentrations. That this is not precisely possible, as the figures in table I show, is because the resultant curves from plotting kill against concentration of most insecticides approach a rectangular hyperbola.

ADDENDUM ON VEHICLE FOR SPRAYS

The volatility of the oil must be considered. The flash point must not be less than 49° C. (120° F.); otherwise the inflammability may be such as to render it dangerous for use. On the other hand, the oil must be sufficiently volatile to evaporate without leaving an oily residue on objects with which the spray may come in contact. It must have the correct initial boiling point and correct distillation point in order to produce a mist which hangs properly; otherwise an excess of heavy portions causes the spray particles to drop too quickly, while an excess of light portions will cause the spray to evaporate too quickly.

Finally, there is to be considered the odor, or lack of odor, desirable in an insecticide base. The raw distillate has a very strong odor which is disagreeable in any insecticide base. The best procedure is to refine the base to that point at which the odor is least disagreeable. It is believed that the most satisfactory base is a straight-run product from a paraffin base crude having an initial boiling point not below 350° F., and an end point not exceeding 510° F. A base with an initial boiling point of 350° F., will easily meet a minimum flash point of 125° F., by the Tagliabue closed cup method. Experience has been that these

initial and end boiling points give a fraction of proper volatility and suspension, and thus meet a very important requirement of a liquid insecticide of the spray type.

Most deodorized kerosenes now on the market come within the above mentioned specifications.

CONCLUSIONS

1. A concentration of 15 percent 20-1 pyrethrum concentrate with 5 percent Lethane 384 in deodorized kerosene provides an extremely efficient spray of the liquid insecticide type.

2. The inclusion of 5 percent Lethane 384 enhances the insecticidal power of pyrethrum and adds materially to the moth repellent properties of the spray.

3. The properties of volatility and suspension required of a liquid insecticide are provided by most deodorized kerosenes now on the market.

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SOME DISEASES OF THE PERIPHERAL ARTERIES¹

By EDGAR V. ALLEN, M. D., Division of Medicine, The Mayo Clinic,
and
IRVIN L. NORMAN, Lieutenant, Medical Corps, United States Navy,
Fellow in Medicine, The Mayo Foundation,
Rochester, Minn.

The growth of interest in the past 10 years in diseases of the peripheral arteries constitutes one of the noteworthy events in medicine in this period. Before this time, care of patients with disturbances of the peripheral circulation was characterized in a large degree by lack of interest and information; sufferers, consulting physician after physician, received conflicting diagnoses and advice and little relief, which resulted in long periods of distress, exaggerated economic loss

¹ Submitted for publication Aug. 27, 1936.

and, in many instances, eventual dismemberment. Out of the chaotic state described in brief have arisen studies in physiology, chemistry, roentgenology, pathology, allergy, and bacteriology which have enhanced our knowledge of, and contributed substantially to, the treatment of patients with diseases of the peripheral arteries. The contributions to the study of diseases of the peripheral arteries are extensive and impressive.

Orderliness in understanding is best served by a simple classification of diseases of the arteries, and such a classification is given in table 1. A summary of the important points of value in the differential diagnosis is given in table 2.

We may remark parenthetically that color of the extremities is of little diagnostic value, and that when too much stress is placed on this single manifestation, errors in diagnosis result. Thus vasomotor changes simulating Raynaud's disease may be a symptom of thrombo-angiitis obliterans (5), and the excessive redness of the extremity in the dependent position in thrombo-angiitis obliterans and arterio-sclerosis obliterans may be erroneously attributed to erythromelalgia.

Mechanical methods are likewise of little value in diagnosis. Such procedures serve their best function in physiologic studies and records of vascular disease, and as such they are worthy of great respect; careful examination of the patient and of his symptoms, however, are adequate for diagnosis in all but a small percentage of cases. Careful examination of patients with suspected disease of the peripheral blood vessels is an absolute *sine qua non*. This consists of careful palpation of the dorsalis pedis, posterior tibial, popliteal, femoral, radial, and ulnar arteries for pulsations, determination of the effect of posture on the color of the extremities, search for inflamed or thrombosed superficial veins and for varices, estimation of the temperature of the parts, and notation of atrophy, minor trophic changes, or frank gangrene.

RAYNAUD'S DISEASE

Diagnosis.—The confusion in diagnosis, which is indicated by even a cursory survey of the literature on Raynaud's disease, seems to have a single basis: departure from the criteria stated by Raynaud. These criteria are: (1) intermittent attacks of changes of color of the acral parts, (2) symmetrical or bilateral involvement, (3) absence of clinical evidence of occlusive lesions of the peripheral arteries, and (4) gangrene or trophic changes, when present, limited in large degree to the skin. To these four criteria laid down by Raynaud we have added a fifth and a sixth; (5) the disease must have been present for a minimal period of 2 years, and (6) there must be no evidence of disease to which it could be secondary (6, 8). These additional criteria have been found necessary to exclude the secondary type of vasomotor disturbance.

Etiology.—Ninety percent of patients with Raynaud's disease are women. They are ordinarily of asthenic bodily constitution, have unstable nervous reactions of a general nature, and are subject to states variously described as neurasthenia, chronic nervous exhaustion, psychoneurosis, and so forth. We feel that Raynaud's disease is a manifestation of inferiority of the sympathetic nervous system expressed by heightened or abnormal reactions to ordinary stimuli (8).

Symptoms.—In many instances the vasomotor changes are mild; pallor is most common, representing the simplest phase. Cyanosis is the next most common, occurring usually following pallor but occasionally alone. Rubor is least common. The various colors of the involved parts do not uniformly follow one another with precision. Pallor may be transformed into cyanosis in an irregular, patchy manner, and may give way to rubor while pallor is still present in other acral parts. Occasionally, when these discolorations are provoked for study, one may see all phases at the same time, pallor, cyanosis, and rubor, on the digits of a single extremity. The digits uniformly appear normal between episodes of discoloration in the early stage before permanent changes have occurred. These episodes of discoloration of the digits are usually provoked by lowered environmental temperature but they may be associated with emotional stress and occur during periods of anger, fear, weeping, and so forth.

As the disease advances, recovery between periods of discoloration is less complete; small necrotic areas, the size of a pin-head and representing capillary thrombosis, occur on tips of the fingers; scleroderma may appear. Absorption of the distal phalanges, leading to the appearance of clubbing of the fingers, may occur, or recurrent paronychia infections may take place.

The tendency of the condition to become progressively worse is usual, but not uniform. The condition may remain in the early stages for many years. It is important to stress that gangrene of marked degree does not occur. We have never observed an instance in which it was necessary to amputate a limb or digit.

Physiology.—The various colors of the skin of acral parts are explained by observation of the vascular structure of the nail fold. During the phase of pallor, the capillary loops are constricted and incompletely filled, and many are invisible; the blood is not flowing. When cyanosis supervenes the capillary loops have gradually dilated and an increased number are visible; the contained blood is blue and its flow intermittent. The surface temperature is low. If the dilation of recovery is excessive, rubor is present. The surface temperature is high, the flow of blood in the capillaries is rapid, and the color of the blood is red. The capillary blood pressure falls below normal during the stage of pallor and increases to above normal during the reactionary rubor.

Treatment.—Residence in a warm climate and freedom from nervous and mental strain may cause amelioration of symptoms in cases uncomplicated by scleroderma, other trophic changes, or recurring infections. Surgical attack on the sympathetic nervous system is, in our experience, the most satisfactory method of treating Raynaud's disease (1). Selection of cases for operation depends largely on the clinical syndrome presented. Patients with the uncomplicated forms of the disease; that is, with recurrent episodes of discoloration of the digits, are selected for operation if the disease appears to be progressing or if annoyance from the condition warrants it. Occasionally operation may be recommended as a prophylactic procedure, for the results are excellent and complications which might ordinarily occur later are avoided. The results of a thoroughly executed operation in this type of case may ordinarily be indicated by the word, "cure".

When scleroderma, chronic discoloration of the digits, recurrent infection, or trophic changes are present, operation on the sympathetic nervous system is advisable if sufficient available vasodilatation can be demonstrated, for no other method of treatment of value is known to us. The results in this type of case are not as striking as in the uncomplicated cases, apparently because the disease in this stage is not due to a fault of vasomotor innervation alone; organic changes, partially or largely irreversible, are also present. However, cessation of distress and infection, improvement in the color of the digits, and softening of the sclerodermic skin are observed.

A few words should be said here about the confusing reports of the efficacy of sympathectomy in Raynaud's disease. Neurosurgeons are agreed that the results of operation for Raynaud's disease of the lower extremities are uniformly excellent. Incomplete results follow cervicothoracic sympathectomy when the disease is complicated or far advanced, or when sympathectomy is incomplete. The latter state is demonstrated by ability to induce sweating of the extremities, for when sympathetic control is completely removed, sweating cannot be induced by artificial means in the regions under consideration. In addition, one may occasionally see a case in which the disease was not far advanced and, as far as could be determined, the operation was complete yet the results were not excellent. Explanation of this situation is not entirely clear. An illustrative case of Raynaud's disease is as follows:

Case 1.—A white, single woman, 21 years old, was admitted to the Mayo Clinic on January 27, 1936. In January 1934 she had noticed that, on exposure to cold, the distal two phalanges of the fingers of both hands suddenly became white and cold. When warmed, they became red and hot. During the winter of 1935 the attacks occurred oftener and with less provocation, so that the color changes occurred not only when the patient was out of doors but while she was in the house near an open window or when she immersed her hands in cold water. The area involved by these color changes increased to involve the entire phalanges. The toes were affected in a similar manner.

On examination, the hands and feet were excessively moist with perspiration. The arteries at the wrist and ankle pulsated normally. Scleroderma, trophic changes and pallor on elevation of the hands and feet were absent. Arteriography of the hands (12) revealed abnormally small digital arteries. Dr. Craig performed bilateral cervicothoracic sympathetic ganglionectomy, removing the stellate and the second thoracic sympathetic ganglion and dividing the communicating rami bilaterally.

ERYTHROMELALGIA

Primary erythromelalgia is an extremely rare disease. The symptoms consist of attacks of burning pain in the extremities, accompanied by a sharp increase in the surface temperature, distention of the superficial veins, and relief of the distress on exposure to cold (16). Occasionally, elevation of the temperature of the skin may be constant rather than intermittent. In other cases elevation of the temperature of the skin, by any means, to a "critical level" causes burning distress, and when the temperature of the skin decreases to less than the "critical level", the distress disappears. Gangrene does not occur. Treatment is usually unsatisfactory, although the local application of radium has been followed by relief in several instances. Section, crushing, or injection of peripheral nerves may give relief. Infection or inhalation of a solution of epinephrine chloride may diminish or alleviate distress. Immersion of the extremities in water, the temperature of which is increased about 2° C. every three or four days, may be tried. Secondary types of erythromelalgia may be associated with peripheral neuritis, polycythemia, and thallium poisoning.

Burning paresthesia should not be confused with erythromelalgia. Patients with this condition complain of sensations of burning in the extremities, which, however, are cold. It is essential to remember that erythromelalgia and burning paresthesias are frequently important symptoms of polycythemia and constitute clues to the correct diagnosis.

Case 2.—A Russian Jew, 64 years of age, was admitted to the clinic June 9, 1936, complaining of a burning distress of the right foot which had been present constantly for 2 years. Three-and-a-half years previously, he had noticed burning distress in the distal half of his left foot which disappeared spontaneously after 3 months. The distress involving his right foot occurred spontaneously during the day, the attacks lasting from half a day to all day. These attacks became more and more frequent until, just prior to his admission to the clinic, the distress had become constant and so severe that codeine sulphate was frequently required for relief.

On examination there was noted a reddish cyanotic color of the feet, hands, conjunctiva, lips, and buccal mucosa. The spleen on deep inspiration was palpable 2 fingers' breadths below the left costal margin. The right foot was distinctly warmer than the left to palpation. The skin of the right foot was found to be approximately 3° C. warmer than that of the left foot. The peripheral arteries pulsated normally. Roentgenologic examination of the legs revealed evidence of arteriosclerosis. The neurologic and general examinations otherwise were negative. Studies of the blood gave the following results: Hemoglobin, 18.2 gm per 100 cc; erythrocytes, 5,430,000; hematocrit, 57 percent; viscosity, 8.2; and whole

blood volume, 102 cc per kilogram of body weight. A diagnosis of polycythemia and erythromelalgia was made. Venesection was carried out until the hematocrit reading was normal. The distress in the foot was not influenced. Radium was applied locally, but the patient left our observation before the results of this treatment could be evaluated.

THROMBO-ANGIITIS OBLITERANS

Etiology.—The etiology of this condition is unknown, but the vascular changes are probably effected by bacteria or their toxins (17, 18). Suspicion has recently been directed toward tobacco, but characteristic examples of the disease have been observed in non-smokers. Vasoconstriction and lowering of the surface temperature follow tobacco smoking (15), but the assumption that tobacco smoking produces organic changes in the arteries is entirely unwarranted. The act of smoking doubtless contributes to the diminution of blood supply to the extremities; this appears to be the sole effect. Recent studies have indicated that patients with thrombo-angiitis obliterans are sensitive to tobacco in an allergic manner; this work, however, needs to be confirmed, and more evidence needs to be advanced that organic arterial changes can be produced by allergic reaction before tobacco smoking can be accepted as a true etiologic factor (21).

Pathology.—The pathologic changes consist of subacute, or chronic relapsing and patchy inflammation of the arteries and veins which leads to thrombosis of those vessels. These thrombi may be canalized. The regional nerves may be involved in the process of inflammation and degeneration (18).

Arteriographically, the characteristics are patchiness of the disease, stages of involvement of arteries varying in degree, and evidence of collateral circulation (4, 10, 11, 12).

Vessels involved.—The arteries of the legs are involved in about 74 percent of cases, the arteries of the legs and arms in about 24 percent, and the arteries of the arms alone in about 2 percent. Arteries of parts other than the extremities are affected very rarely, although the coronary (13), renal, mesenteric, and cerebral arteries may be diseased by a process indistinguishable from that of thrombo-angiitis obliterans. Deep veins are frequently diseased, although not extensively, and the superficial veins are inflamed and occluded during some period of the course of the disease in about 44 percent of cases.

Symptoms.—All the symptoms of thrombo-angiitis obliterans are due to inflammation or thrombosis of the arteries and veins or to unstable vasomotor control resulting from this. Claudication is an aching or cramp-like distress occurring chiefly in the calves, which is characteristically brought on by continuous exercise and is relieved by rest. This distress does not result from standing however prolonged, sitting, or recumbency.

Lowered surface temperature of the parts, small ulcers, or frank gangrene, callousing of the skin over weight-bearing areas, and impairment and irregular growth of the nails, may result from the constantly diminished blood supply.

Rest pain, so-called to distinguish it from the distress of claudication, which is provoked only by exercise, results from death of tissue as in ulcers or gangrene, or from ischemic neuritis. In the former instance pain is localized in the area of the lesion, in the latter it is diffuse, involving comparatively large portions of the extremity; it may be associated with hypalgesia or hyperesthesia of the skin or with diminished tendon reflexes.

Abnormal pallor of the skin when the extremity is elevated, and constant abnormal rubor when the extremity is dependent, are entirely pathognomonic of occlusion of the main arteries. Local inflammation of the superficial arteries and veins causes redness and tenderness during the acute phases; when inflammation has subsided, the veins or arteries may be felt as hard cords beneath the skin. Vasospastic disturbances, consisting of pallor, rubor, and cyanosis in any combination, when intermittent as in Raynaud's disease, are indicative of an increased lability of the vasomotor mechanism resulting from inflammation in the arteries. Gangrene, when present, varies in extent and degree.

Clinical types.—The compensated type of thrombo-angiitis obliterans is characterized by intermittent claudication which does not progress over a period of years. In the slowly progressive type, claudication occurs after progressively shorter periods of exercise; trophic changes, frank gangrene, or ischemic neuritis may occur. In the type with sudden arterial occlusion, pain, pallor, and coldness of the extremity supervene suddenly; palpation discloses occlusion of the arteries (24). The arteries of other limbs may be found to be occluded, or occlusion may occur subsequently. In other types, vasomotor changes suggesting Raynaud's disease may be predominant, or ulcerations or minor degrees of gangrene may recur in the absence of other symptoms.

Prophylactic measures in treatment.—The chief aim of treatment in thrombo-angiitis obliterans is the prevention of gangrene. The program is the same as has been so well publicized for the prophylactic care of the feet in diabetes. Trauma should be avoided, new shoes should be worn for only short periods until thoroughly broken in, protection from cold is essential, and application of strong ointments or solutions containing iodine, phenol, and other irritating substances is sharply interdicted. Such preparations, although well tolerated by patients with normal circulation, may lead to ulcers or gangrene in a patient with thrombo-angiitis obliterans. Immersion of the feet in solutions of potassium permanganate is preferable to the use of solu-

tions containing iodine or salicylic acid in the treatment of trichophyte infections. Cleanliness of the feet is important.

Medical measures to increase the circulation.—Postural exercises consist of alternate elevation and dependency of the extremities for periods of 1 minute each for 15 minutes, two or three times daily. These exercises tend to increase the collateral circulation. Alternate immersion of the extremities in water of approximately 40° and 105° F. for periods of 1 minute each, for 15 to 30 minutes three times daily, seems to help. The extremities may be warmed by exposing them to the heat from one or two carbon filament bulbs in bakers such as are commonly used in the treatment of arthritis. This is best carried out when the patient is resting from his work at noon or in the evening while he reads. Absolute cessation of smoking is important. The physician should refuse to treat patients who do not completely cease smoking. Alcoholic liquors in moderation (19), theobromine in amounts of 10 grains (0.65 gm) three times daily (25), or acetyl-B-methylcholine (mecholin) in amounts of 1,500 mg by mouth (20), increase the circulation to the extremities temporarily.

The artificial induction of fever is the most satisfactory method of increasing circulation. This is best accomplished by intravenous injection of typhoid vaccine two or three times a week (14). An amount of vaccine containing approximately 15 million organisms is injected the first time and increased by an amount each subsequent time. At a temperature of 102° F., chills, nausea, and headache frequently occur but are well tolerated. Recently, Herrmann and Reid have reported the use of an alternating positive and negative pressure to the extremities (22). Our own experience, which has been extensive, is not entirely favorable, but we continue to use this method of treatment because it seems to be of definite aid in certain cases (9). Intravenous injections of 300 to 500 cc of a 3 to 5 percent solution of sodium chloride, once or twice a week, appears to help in some cases. The rationale of this treatment, however, is obscure. Rest in bed is important when ulceration occurs. Treatment is most successful in cases of thrombo-angiitis obliterans when several methods are used. Thrombo-angiitis obliterans is a self-limited disease which eventually becomes quiescent; the problem of treatment is one of preserving the extremities until this occurs.

Surgical measures to increase the circulation.—The confusion that exists regarding the value of sympathectomy can best be clarified by a statement of what the operation accomplishes. The disease is not cured or arrested, superficial phlebitis and intermittent claudication are not significantly influenced by it, gangrenous tissue is not restored to normal, and the pain of ischemic neuritis and gangrene is not relieved. As a result of these observations, sympathectomy is never performed when pain is severe, when gangrene is present, or when

trophic changes are marked. The operation has but a single purpose: To increase circulation to the extremities as much as possible. This is routinely accomplished in suitable cases by sympathectomy, and circulation remains as adequate as possible, an achievement only temporarily effected by other methods, such as artificially induced fever. Careful studies have indicated that sympathectomy is a valuable procedure, and the results in the direction of a diminished percentage of amputations are gratifying (2).

The treatment of claudication.—The newer tissue extracts almost always increase the distance an individual can walk before the distress of claudication occurs. Sharp and Dohme's tissue extract number 568 may be injected intramuscularly twice weekly in amounts of 3 cc. Pain at the site of injection is alleviated somewhat by massage and by the application of a moist, warm pack. Myoston may be given intramuscularly in amounts of 2 cc two or three times a week, or by mouth (26), 40 drops, three times daily, about three times a week. Unfortunately, at the present time, these preparations are expensive and frequently unstable. In the future they will certainly be prepared more cheaply and in a standard and stable form. They do not increase the circulation to the extremities, but produce their effects on the distress of claudication in some way as yet not clear.

The treatment of rest pain.—Ischemic neuritis is characterized by constant rest pain when evidence of death of tissue is lacking. The pain is very resistant to treatment, and in this regard resembles that of diabetic neuritis. Rest, the ingestion of alcohol, sedatives, the intramuscular injection of tissue extract, the intravenous injection of calcium gluconate, injection of alcohol into, or section of, the peripheral sensory nerves, the intravenous injection of typhoid vaccine, and intermittent suction and pressure constitute the best therapeutic agents available. Ordinarily the pain disappears after a distressing period. When gangrenous ulcers are painful, relief frequently follows the local application of such anesthetic agents as diothane.

Orthopedic treatment.—Amputation is necessary when a digit or an extremity is hopelessly involved with gangrene, or when rest pain cannot be relieved by a prolonged trial of medical treatment. Amputation of fingers is uniformly successful. In our experience it has never been necessary to amputate a hand. Healing only infrequently follows amputation of the toes, and whenever such amputation is to be carried out, the surgeon must prepare the patient to accept amputation of the leg also if healing should not follow. Amputation is successful below the knee in about 80 percent of cases.

Case 3.—A white man, 38 years old, was admitted to the clinic June 15, 1936. He had smoked about 20 cigarettes daily until 6 months before admission when he had stopped smoking altogether. For 1½ years prior to admission he had noticed distress in both ankles and in the left calf on walking, but this pain had

never been severe enough to cause him to stop. Four months previously he had frozen the toes of his right foot and 1 week later a small ulcer had developed on the tip of his right big toe. This ulcer had not healed and gangrene and severe pain had developed. The toe had been amputated and healing had occurred.

On examination at the clinic, pulsations were found to be absent in the dorsalis pedis and posterior tibial arteries, bilaterally. Pulsations were diminished in both popliteal arteries and in the left ulnar artery. On elevation, both feet blanched excessively and, when they were dependent, there was excessive rubor. As a result of fever (1.2° C.) induced by typhoid vaccine injected intravenously, the temperature of the right third toe increased from 29.7° to 33.4° C., that of the left first toe from 26.5° to 34.1° C., and that of the left third toe from 26.2° to 33.9° C. Available vasodilation was therefore demonstrated, and bilateral ramisection and ganglionectomy was performed by Dr. Love on June 15, 1936. Study following the operation showed that there had been a marked increase in skin temperatures, indicating increased circulation. The patient recovered from the operation satisfactorily and was dismissed with instructions to continue to abstain from tobacco smoking and to take good care of his feet.

THROMBO-ARTERIOSCLEROSIS OBLITERANS

Thrombo-arteriosclerosis obliterans is a name suggested to replace the terms, "endarteritis obliterans", "senile gangrene", "arteriosclerosis with occlusion", and so forth. It describes a clear-cut pathologic entity, as does the term "thrombo-angiitis obliterans", namely, arteriosclerosis and occlusion of an artery by a thrombus which occurs characteristically among people of advanced age.

Etiology.—About as little and as much are known about the cause of this disease as is known about the cause of arteriosclerosis generally. For lack of better information, resort must be had to the conventional statement that it represents wear and tear on arteries, a process of aging.

Pathology.—The characteristic pathologic findings in thrombo-arteriosclerosis obliterans are calcareous degeneration of the media, proliferation of the intima, and eventual occlusion of a lumen by a thrombus. Signs of inflammation and perivascular fibrosis are absent. The roentgenographic findings following intra-arterial injections of a radiopaque substance are calcification of the arteries and shagginess of the lumen.

Symptoms.—The symptoms of thrombo-arteriosclerosis obliterans are due to diminution in the supply of blood to peripheral parts, which almost uniformly are the lower extremities. These symptoms are intermittent claudication, coldness, excessive redness when the feet are dependent, excessive pallor when the feet are elevated, pain due to trophic changes, ischemic neuritis, and death of tissue. The symptoms have been described more in detail under the heading of thrombo-angiitis obliterans. Recurrent superficial phlebitis occurs in thrombo-angiitis obliterans alone, and the pain due to death of tissue that occurs in the last-mentioned condition is more severe than in thrombo-arteriosclerosis obliterans. The characteristic findings on

examination are absence or diminution of pulsations in the peripheral arteries, excessive rubor and pallor on dependency and elevation, respectively, and varying degrees of death of tissue. Evidence of diabetes should always be sought.

Treatment.—The treatment is essentially the same as for thrombo-angiitis obliterans, with the following exceptions: The intravenous injection of typhoid vaccine is ordinarily not advisable because patients of advanced age do not tolerate the reactions well. Fever which increases the peripheral circulation can be induced by the injection deep into the muscles of the thigh (3, 27) of 2 or 3 cc of a 2-percent solution of sulphur in olive oil. The single drawback to this procedure is the pain at the site of injection, and this pain should be controlled with morphine and the local application of hot packs. Sympathectomy is not indicated in thrombo-arteriosclerosis obliterans because adequate vasodilation will not ordinarily follow, and the operative risk is higher, owing to the advanced age of the patients. Amputation, when necessary, is successful more frequently above the knee than below it. Healing following amputation of toes occurs less frequently than following a similar procedure in thrombo-angiitis obliterans. In our experience it has never been necessary to amputate fingers in thrombo-arteriosclerosis obliterans.

Case 4.—A white farmer, aged 70 years, was admitted to the clinic February 25, 1936, complaining of pain in his left foot. Intermittent claudication had affected his left calf for 1 year. Because of paresthesias, incisions had been made by a chiropodist in his left heel and in the nail of his left first toe. Eight weeks were required for healing. Two weeks before admission, a blister had appeared on the under surface of the left first toe; this had broken and left a shallow ulcer. The pain, which was localized in the left big toe, came in paroxysms that were especially severe while the patient was resting and at night. The tissues of the toe were so sensitive that the weight of the bed clothes at night could not be borne.

On examination, moderate hypertension, oral sepsis, auricular fibrillation, and moderate cardiac enlargement were noted. The left foot was red and edematous; there was ulceration of the plantar surface of the left first toe, and absence of pulsations in the right and left posterior tibial arteries and in the left dorsalis pedis artery. Pulsations were diminished in the right dorsalis pedis artery. Marked blanching of the feet was noted when they were elevated and the left foot was colder than the right one. The patient was treated by rest in bed, radiant heat, and soaking the feet in a warm saturated solution of boric acid. The pain disappeared promptly and the ulcer healed. The patient was dismissed and instructions were given relative to care of the feet.

ARTERIOVENOUS FISTULA

Normally, blood flows from the arteries through the capillaries into the veins. In arteriovenous fistula the blood, taking the course of least resistance, flows from the artery directly into the regional veins. These veins become dilated and tortuous and are frequently mistaken for varices. All patients with varicose veins should be examined with arteriovenous fistula in mind. Arteriovenous fistulas are of two

types: congenital and acquired (23). The latter ordinarily follows gunshot and stab wounds. In congenital arteriovenous fistula there is overgrowth of bones in a longitudinal direction, causing obvious lengthening of the limb. This occurs also in arteriovenous fistula acquired before the epiphyses close. Additional findings are: thrill and bruit over the acquired fistula, a higher surface temperature over the fistula than of the normal limb, and the occurrence of ulcers, distally, because of deficient blood. The most conclusive test is the demonstration of arterial blood in the regional veins. Occasionally, observation of red blood withdrawn from veins is sufficient to make a diagnosis, but usually it is necessary to determine the oxygen content of the blood. Surgery which is successful for the acquired type of fistula is usually of no avail for the congenital type because of the multiplicity of the communications. Under such circumstances snug bandaging of the extremity may force the blood to follow its normal path. Occasionally the dilated veins can be occluded chemically.

SUMMARY

Raynaud's disease, erythromelalgia, thrombo-angiitis obliterans, thrombo-arteriosclerosis obliterans, and arteriovenous fistula are definite clinical entities recognizable from a carefully taken history and by careful examination of the patients.

Rational medical, orthopedic, and neurosurgical treatment has accomplished much in the alleviation of symptoms and preservation of extremities in these conditions.

TABLE 1.—*Clinical classification of arterial vascular disease*

Functional or vasomotor types-----	Local distribution..	Vasoconstricting type—RAYNAUD'S DISEASE.
	General distribution..	Vasodilating type—ERYTHROMELALGIA.
Organic types-----	Local distribution..	Vasoconstricting type—Primary or essential hypertension, early stages.
		Vasodilating type—Primary or essential hypotension.
	General distribution..	1. THROMBO-ARTERIOSCLEROSIS OBLITERANS.
		2. THROMBO-ANGIITIS OBLITERANS.
		3. Simple thrombosis: embolism.
		4. Arteriovenous communications (congenital, acquired).
	General distribution..	5. Aneurysm. with or without thrombosis.
		ARTERIOSCLEROSIS:
		1. Primary.
		2. Secondary types due to hypertension, lead, and so forth.

TABLE 2.—*Differential diagnosis of vascular disease affecting the extremities*¹

	Thrombo-angiitis obliterans	Arteriosclerosis obliterans	Raynaud's disease and similar conditions	Primary erythromelalgia
Age.....	Between 25 and 45 years.	Between 55 and 85 years.	Between 17 and 35 years.	Between 30 and 50 years.
Sex.....	Males, 99 percent.	Males, 90 percent.	Females, 90 percent.	Females, 70 percent.
Race.....	Jewish, 42 percent. Pulseless 50 percent.	Any. Pulseless 50 percent.	Any.....	Any.
Pulsation of arteries.....	Diminished 45 percent. Normal 5 percent.	Diminished 45 percent. Normal 5 percent.	Normal.....	Normal.
Claudication.....	Usually present.	Usually present.	Absent.....	Absent.
Excessive rubor with dependency.	Present.....	Present.....	do.....	Do.
Excessive pallor with elevation.	do.....	do.....	do.....	Do
Gangrene.....	Common.....	Common.....	Rare, of minor degree.	Never.
Rest pain.....	Usually very severe.	Usually mild.....	Usually absent.....	Mild to severe.
Type of rest pain.....	Sharp, stinging.	Aching.....	Absent.....	Burning.
Appearance of gangrenous ulcers.	Moist, inflamed; discharging.	Usually dry.....	Small punched-out areas ²	None.
Superficial phlebitis.....	30 percent of cases.	Absent.....	Absent.....	Absent.
Roentgenogram of arteries.	Usually negative for sclerosis.	Usually positive for sclerosis.	Negative.....	Negative.
Color changes following exposure to cold.	30 percent.....	15 to 20 percent.....	Always.....	Never.
Temperature of extremities.	Low.....	Low.....	Low.....	High during attacks.
Edema.....	Frequent.....	Infrequent.....	Absent.....	Absent.

¹ Percentages are approximate.² In early states.

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A REVIEW OF TRACHOMA

By O. W. COLLE, Lieutenant, Medical Corps, United States Navy

The object of this paper is to present the subject of trachoma in the light of recent investigations and advances in its recognition and treatment. Trachoma rarely occurs among naval personnel or their families, but the diagnosis of trachoma is too frequently applied erroneously by medical officers, inexperienced in the recognition of

this disease, resulting in an unnecessary amount of worry to the patients or to the parents of children who are suffering from some conjunctival condition which has been so erroneously diagnosed. Also there is irreparable damage to the delicate ocular tissues when vigorous treatment is instituted for a condition that does not exist. The writer has been impressed by the large number of cases that were diagnosed and vigorously treated as trachoma, among the dependents of naval personnel, especially those on the Asiatic Station, during the years 1933-34. Based upon the number of such cases which have reported to the writer, requesting continuation of treatment for conjunctival conditions which were diagnosed as trachoma on the Asiatic Station during those years, and many other cases revealed by consulting other medical officers, a conservative estimate would reveal about 250 dependents and at least a dozen active personnel under vigorous treatment for trachoma.

The difficulty in forming a concise picture of trachoma is considerable, because we are dealing with a condition, the causative agent of which has not been conclusively proven. In spite of more than 50 years of painstaking research, its etiology still remains obscure. Until recently, no uniformly susceptible experimental animal was known. We have not been able to find any organism constantly present in all cases of trachoma, nor have we been able to produce the disease by any organism which has been cultured from trachoma cases.

While the majority of workers maintain that trachoma is communicable and consequently due to either a bacteria or a filterable virus, yet even this point remains unsettled, for as yet the Koch's postulates have not been fulfilled for any causative organism.

Thirty years ago Prowazek and Halberstaedter announced the discovery of inclusion bodies as the causative agent of trachoma. Yet no one has proved or disproved their etiological significance. Similar inclusion bodies have been found in cases of inclusion blenorrrhea, vernal catarrh, and various other conditions.

Dietary or vitamin deficiency has been suggested as the etiological factor of trachoma. We have long known that trachoma is much more frequent in people of the lower social classes who are associated with crowded living conditions and poor hygiene, yet cases of trachoma do occur in individuals of the higher social classes, who are not associated with such conditions.

Also, attempts to produce an increased susceptibility to trachoma in humans and animals by depriving them of vitamin A have not been successful, nor has scientific feeding with well-balanced or high-vitamin diets shown any tendency to cure trachoma.

Of the several bacterial agents which have been suggested as the etiological agent of trachoma, perhaps the most important is the

bacterium granulosis. In few instances monkeys have been successfully inoculated with it, but the folliculosis which followed did not show the pannus and scar formation which are characteristic of trachoma. Attempts to inoculate humans with this bacterium have not been successful.

It has also been suggested that the causative agent is a filterable virus; however, except in possibly a few isolated instances, attempts to induce the disease by the use of filtrates of trachomatous material have been unsuccessful. Thygeson, Phillips, and Proctor state that epithelial scrapings from trachoma contain a virus which is capable of passing through collodion filters impervious to conjunctival bacteria, and that this virus produces in baboons the same type of follicular disease as that produced by direct inoculations with trachomatous material. These experiments have not thus far been checked on humans. Stewart has advanced the hypothesis that trachoma is due to a virus which is introduced into the conjunctiva in the bodies of bacteria or several species of bacteria. That these bacteria, acting as intermediate hosts are phagocytosed to form the Prowazek-Halberstaedter bodies, which are the ports of entry for the elementary granules of the virus; that the latter are liberated by the bursting of inclusions and are dispersed throughout the conjunctiva, becoming no longer recognizable. Thus we see that the question of the etiology of trachoma is still unsettled. Is it a bacterial infection, a filtrable virus, a vitamin deficiency, or a disturbance of the reticular tissue of the eyelids due to poor hygiene?

MacCallen has given us perhaps the best classification of trachoma. He has divided it into four stages. Yet there is no clear line of demarkation between these stages. One lapses into the other, and two or three may be present at the same time. Corneal ulcers may appear early, although they do not usually occur until late in the disease. In some cases they may not appear at all. Follicles may persist throughout the course of the disease. Scar formation may begin early or late. The earliest visible changes noted in trachoma consists of a congestion of the larger vessels of the upper tarsal conjunctiva, together with swelling of the capillaries. Each small swollen capillary appears as a small red dot on the conjunctiva. These capillaries become replaced by polygonal bright red plaques which are separated by clear linear spaces. These plaques represent the first stage of trachoma or, as MacCallan has called it, trachoma I.

The plaques are really the beginning of trachomatous papillae. The papillae hypertrophy and give the tarsus a velvety appearance. About this same time follicles begin to appear in the swollen retro-tarsal conjunctiva. Clinically, there is usually a watery mucoid discharge toward the end of this stage.

The transition from trachoma I to trachoma II is gradual, the follicles hypertrophying and becoming more numerous. They gradually invade the bulbar conjunctiva and it becomes cloudy and lusterless. During this stage, the papillae of the retrotarsal conjunctiva hypertrophy. During trachoma II there is a sticky mucoid discharge, which is considered by many investigators to be highly infective.

Following this, the period of cicatrization begins. This is designated as trachoma III. It may progress rapidly or slowly, and may terminate in trachoma IV, the stage of complete cicatrization, with its complications of trichiasis, entropion, and symblepharon.

Cicatrization begins at the sites of the early follicles, which either rupture and discharge their contents or are invaded by fibrous connective tissue. These small scars which may be seen early by the biomicroscope appear stellate in design and are considered pathognomonic of trachoma.

Early in trachoma I, by means of the slit lamp, we may see the first signs, of pannus formation. Small capillaries begin to invade the cornea. At first the pannus is only superficial, but it may involve the deeper corneal layers. Howard states that it is his opinion that if a case does not show pannus formation within 4 to 8 weeks, then it will never show any, and is not a case of trachoma.

Peters has demonstrated the presence of a reticular tissue of lattice fibers in trachomatous conjunctivae. He also recognized a transition of lattice fibers in some places into collagenous fibers. He concluded that these lattice fibers may at least introduce the process of cicatrization.

The question of transmission of trachoma in experimental animals has been a point of bitter controversy. Some workers have claimed that they were able to transmit the disease, while others have denied this and stated that the experimental disease which was produced in the animals was not trachoma, but merely folliculosis. Certainly, if trachoma is transmissible at all, it is only mildly so, and as such differs markedly from inclusion blenorrhea which is highly infectious. In view of the absence of pannus formation and the very slight tendency to cicatrization in inclusion blenorrhea, it cannot be considered as a trachoma of genital origin, but must be considered a distinctly different disease entity.

Other conditions from which we must differentiate trachoma are follicular conjunctivitis, vernal catarrh, swimming bath conjunctivitis, and the hypertrophic condition of the lymphoid tissues of the conjunctiva of children which has been so properly called "Lymphoid Syndrome" by Commander P. M. Albright (MC), U. S. N.

The granules of follicular conjunctivitis are usually more sharply outlined than those of trachoma, and are often limited to the conjunctival fold. This condition attacks preferably young people of any

social class, and occurs even in countries which are free from trachoma. It does not lead to pannus and scar formation.

In vernal catarrh, the papillae are enlarged and hard, resembling paving stones. There is a delicate bluish-white film of the palpebral conjunctiva. It occurs almost exclusively in juvenile persons and attacks all social classes. It does not lead to scar formation and pannus.

Swimming-bath conjunctivitis occurs in all social classes and in areas where trachoma is not present. There is no tendency to pannus or cicatrization.

There are two schools of treatment of trachoma, the conservative and the radical. The conservatives seek the destruction of the follicles by chemical and mechanical means; whereas the radicals advocate early tarsectomy and canthotomy, and follow this with subsequent treatment of the follicles.

The most standard chemicals in use in the treatment of trachoma are the copper sulphate pencil and a 2-percent solution of silver nitrate. The use of the copper sulphate stick is contra-indicated in cases with acute inflammatory symptoms, or with corneal ulceration. In cases with acute inflammation, a 2-percent solution of silver nitrate is applied to the everted eyelids and followed by irrigation with a warm saline solution. When the acute inflammatory symptoms have subsided the silver nitrate treatment is replaced by the use of copper sulphate pencil which is gently passed along the conjunctiva of the everted lids, being carefully applied to the conjunctiva of the retro-tarsal fold. The excess is removed by irrigation. Mature granules are squeezed out of the conjunctival folds with Knapp's tweezers. Resistant pannus is treated with 1-percent copper sulphate ointment or dusting with dionine powder. Sequelae are treated as they arise.

Experiments using copper sulphate combined with sodium thio-sulphate, and injected intravenously have been recently conducted by Rice, Drake, and Smith, but they have concluded that the possible dangers of this treatment outweigh any slight benefits obtained from it.

Chaulmoogra oil has been used, applied to the conjunctiva and rubbed into the lids, but it has shown no advantage over the standard accepted method of treatment with copper sulphate.

Brecher has used local injections of a bee-sting preparation which is manufactured under the name of Immenin, and has concluded that cases so treated show a definite improvement, with little or no tendency to relapse. This form of therapy should be further investigated before we can establish its value in the treatment of trachoma.

Trachoma certainly is of uncommon occurrence among the personnel and dependents of the United States Navy. Almost every day we meet with eye conditions which we have to differentiate from it, but if we will remember that in all cases of trachoma we will be

able to demonstrate pannus either visible with the naked eye or else with the slit lamp and usually occurring early in the disease; we will find that most of the cases which we are inclined to consider trachoma when first seen are not trachoma, but rather a benign folliculosis. Often these patients are told by someone that they have trachoma, and once they have established this idea in their minds, it is difficult for the medical officer to persuade them otherwise. They demand vigorous treatment, which, if it is administered, will only serve to irritate and aggravate the simple follicular condition, which would probably have responded to a more conservative treatment with mild astringents.

Further, we must remember that all trachoma cases will sooner or later show scar formation, so that cases which give a positive history of trachoma, but which show smooth, clear, conjunctiva with no appreciable cicatrization, never did have trachoma, but were treated for some other more benign condition which was incorrectly diagnosed as trachoma.

To such cases which have come under my observation, that is, those cases which have been incorrectly called or diagnosed as trachoma, I have applied the term "Navy trachoma", but only in discussing them with other medical officers. While such cases have been exceedingly few among active Navy personnel, yet they have been quite common among the dependents of the Navy personnel.

At the same time, we must remember that rare cases of trachoma do occur in service personnel, and if trachoma is an infectious disease, the infectious stage is probably early in the disease. So the key to control of such cases is early recognition by the slit lamp, followed by long-continued treatment.

It may be a difficult problem for us to reduce the very low incidence of trachoma in the naval personnel and dependents any further, but it seems to me that we should find it much easier to reduce the incidence of "Navy trachoma", that is, incorrect diagnosis of trachoma, applied to similar confusing diseases of the conjunctiva.

CLINICAL NOTES

STAPHYLOCOCCUS SPINAL LEPTOMENINGITIS

REPORT OF A CASE CURED BY LAMINECTOMY

By E. M. WADE, Lieutenant, Junior grade, Medical Corps, United States Navy, and F. H. O'NEIL, First Lieutenant, Medical Reserve Corps, United States Army

The incidence of acute spinal leptomeningitis due to the *Staphylococcus aureus* is extremely low. It is usually the result of a blood-stream infection following cellulitis, carbuncle, furunculosis, or by direct extension from vertebral osteomyelitis, or other suppurative processes. The leptomeninges of the brain and spinal cord may be involved simultaneously or separately. Meningitis caused by the pyogenic cocci has been considered almost invariably fatal regardless of the method of treatment. A brief report of a case of acute spinal leptomeningitis due to the *Staphylococcus aureus*, which was cured by lumbar laminectomy with open drainage, is herewith submitted.

On May 27, 1935, a white Civilian Conservation Corps enrollee, age 18, accidentally contused the knuckles of the right hand while working as a mechanic at Big Bar Camp F-27, Big Bar, Calif. He failed to report to the camp surgeon for treatment until 4 days later, at which time his hand was very painful and greatly swollen. He was evacuated from the camp dispensary on June 4, 1935, on which date he was admitted to the St. Joseph Hospital, Eureka, Calif., and was seen by the writers of this report for the first time. Symptoms and signs of an acute suppurative cellulitis involving the dorsal aspect of the right hand were present, together with moderate systemic toxemia. He complained of lumbar pain and aching in the region of the left hip, aggravated by motion of the left leg, which he attributed to a fall incurred several days prior while carrying an armful of shovels over uneven ground. He was placed in bed, and massive, hot, moist compresses were applied continuously to the right hand and arm.

On June 6, 1935, he continued to complain of backache, and general prostration was marked. The temperature was 101, and an area of fluctuation was present on the dorsum of the right hand. This area was incised, and a moderate amount of yellow pus was released.

On June 7, 1935, he appeared very toxic and greatly prostrated. Passive motion of the left leg produced severe lumbar pain which radiated down the left leg. Abdominal distention was marked, and urinary retention was present, necessitating regular catheterization. The temperature ranged from 99 to 101, and the symptoms, and signs of cellulitis of the right hand had practically subsided. The white cell count was 14,200, with polymorphonuclears 89 percent, and lymphocytes 11 percent. During the next 48 hours the symptoms remained essentially unchanged, except for evidence of increased toxicity. The temperature was of the septic type, and varied from 99.8 to 103. On June 9,

1935, there was some stiffness of the neck, and inequality of the patellar reflexes. Other neurological signs were normal. Lumbar puncture revealed a very thick purulent exudate which could be obtained only by aspiration, and at the time it was not possible to determine whether the location of the exudate was actually subarachnoid or extradural. Smears of the exudate stained by Gram's method revealed numerous Gram positive cocci, which were determined by cultural methods to be the *Staphylococcus aureus*. The white cell count of the blood was 25,900, with polymorphonuclears 91 percent, and lymphocytes 9 percent. A blood culture made that date showed no growth.

Operation.—On June 10, 1935, a bilateral laminectomy of the second and third lumbar vertebrae was performed under ether anesthesia. The appearance of the overlying muscles and the epidural fat was normal. The dura was exposed, and was found to be very dark, congested, and tense. A longitudinal incision, about 1¼ inches in length, was made in the dura; the edges of the dura gaped widely, exposing the nerves of the cauda which were greatly swollen and covered with a thick purulent exudate. A tubular, tissue rubber drain was left in the region of the dural incision, and no attempt was made to close the dura.

Upon recovery from the anesthetic, he voided normally for the first time in 96 hours. The postoperative condition was satisfactory. Marked retraction of the neck was noted immediately following the laminectomy, but he was free from symptoms which could not be directly traceable to the laminectomy. There was profuse purulent drainage from the operative wound, the drainage becoming much thinner after the third day. He developed a large subcutaneous abscess in the coccygeal region, which was incised and drained, without anesthesia, on June 14, 1935. The retraction of the neck gradually disappeared, but he progressively became more weak and toxic, with moderate delirium.

On June 15, 1935, his general condition was very poor. The white cell count was 52,800, with polymorphonuclears 83 percent, lymphocytes 10 percent, large mononuclears 2 percent, and eosinophiles 5 percent. Transfusion of 500 cubic centimeters of whole blood was performed by the direct, multiple syringe method. Following transfusion, the delirium rapidly disappeared, and general improvement was marked. He continued to improve, and his temperature returned to normal on the tenth postoperative day. On June 24, 1935, he was improved sufficiently to be transferred 286 miles by rail transportation to Letterman General Hospital, Presidio of San Francisco, Calif., for convalescence.

The drainage from the laminectomy wound gradually subsided, with complete healing of the wound by September 1, 1935. On September 10, 1935, he developed an acute arthritis of both sacroiliac joints, from which he made a rapid recovery. He was released from hospital treatment on October 15, 1935, completely well, except for slight limitation of motion in the lumbar region.

SUMMARY

This case of acute spinal leptomeningitis due to the *Staphylococcus aureus* followed a neglected cellulitis of the hand, and although a positive blood culture was not found, it is evident that a blood stream infection was present. Pain in the back and left hip, marked abdominal distention, urinary retention, prostration and fever were prominent symptoms. Lumbar laminectomy with open drainage of the subarachnoid space, subsequently followed by a transfusion of whole blood, resulted in complete recovery in about 6½ months. The symptoms of urinary retention disappeared immediately following laminectomy. Convalescence was early complicated by a large

subcutaneous abscess in the coccygeal region, evidently of pyemic origin, and later by an acute arthritis of the sacroiliac joints, the cause of which was not determined.

The present-day literature contains accounts of two similar cases treated by laminectomy with open drainage, followed by recovery (1) (2).

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LYMPHOPATHIA VENEREUM¹

REPORT OF A CASE

By W. S. RIZK, Lieutenant, junior grade, Medical Corps, United States Navy

Lymphopathia venereum, or lymphogranuloma inguinale, is a filtrable virus disease, venereally acquired, characterized clinically by an initial inoculatory lesion, or portal of entry of the virus, followed soon thereafter by a satellite lymphadenitis of considerable size, with a tendency to indolent suppuration and the production of multiple sinuses; and with variable constitutional symptoms during the period of invasion of the lymph glands, of malaise, fever and sweats, anorexia, pains in the muscles and joints, nausea and vomiting, prostration, and skin eruptions. Other manifestations of the disease, usually late manifestations, are the anorectal syndrome, chronic hypertrophic elephantiasis and ulceration of the vulva, the esthiomene of French writers, and elephantiasis of the male genitalia.

Lymphopathia venereum has, at one time or another, been described under such names as tropical or climatic bubo (1) (2) (3), nonvenereal bubo (1), bubons d'emblee (4), strumous bubo (5), fourth venereal disease (6) (7) (8), sixth venereal disease (9), and many others. Durand, Nicolas, and Favre (10), in 1913, introduced the terms "lymphogranuloma inguinale" and "lymphogranulomatosis." In 1932 Wolf and Sulzberger (11) advocated the use of the term "lymphopathia venereum" to avoid any confusion of the term "lymphogranuloma inguinale" with other diseases, notably granuloma inguinale and Hodgkin's disease, also known as lymphogranulomatosis. Moreover, the older name was poorly chosen, etymologically, because it fails to include various extrainguinal localizations of the disease, now known to be caused by the same virus.

¹ Read at the monthly medical conference of the staff of the U. S. Naval Hospital, Brooklyn, N. Y., on Feb. 13, 1936.

While lymphopathia venereum has long been classified under its old names as a tropical or subtropical disease, the great interest that the disease has aroused in recent years, particularly since Frei's epochal announcement (12), in 1925, of his intradermal test as a diagnostic procedure, has led to the recognition of the disease in practically every country in the world. Frei estimates that between 300 and 400 new cases of lymphopathia venereum are acquired each year in Berlin alone (13). Simon (14), in France, in Frei testing a group of prostitutes, found 10 percent with positive tests, although clinically showing no signs of the disease. These cases, it is thought, may be carriers, having passed through mild or abortive attacks of the disease. In the United States the disease is not uncommon, especially in the southern States, due to the large negro population, although in the northern industrial centers many cases are recorded annually.

Etiology—Sex.—Prior to the discovery that the anorectal syndrome and esthiomene are but other manifestations of tissue involvement to the virus of lymphopathia venereum, the disease was widely held to be a malady restricted to the male sex. Hanschell (15), of England, and de Bellard (16), of Venezuela, as late as 1926, believed that the disease was unknown in the female. Such views, however, have been found to be erroneous, since the various manifestations of this virus disease have been identified. All statistics agree, however, that there is a preponderating incidence among men, the proportion having been placed variously from 1:25 to 1:4, by different observers. The bubonic type of the disease, because of the lymphatic anatomy concerned, is largely limited to men, whereas the anorectal syndrome, in most clinics, is seen more often in women. Esthiomene is, of course, limited to women entirely. Elephantiasis of the male genitalia is sometimes observed.

Age.—As with other venereal diseases, the incidence is highest during the period of greatest sexual activity, that is, from 20 to 40. Over 90 percent of the cases occur between the third and seventh decades.

Race.—While the disease is generally conceded to be more prevalent among the colored peoples, it is by no means rare among the white population, particularly where interracial sexual relations are practiced. There is a comparatively high incidence among seafaring white men who invade the tropics.

Etiological agent.—So far, no organism has been isolated as the etiological agent, but the successful transmission of the disease from man to animals, man to man, and from animals to man, with not only sections and pus from lymphogranulomatous buboes, but also with filtrates, seems to point to a filtrable virus as the etiological agent.

Mode of transmission.—The venereal character of the disease has been well established. Practically every case seen clinically is the result of sexual intercourse or abnormal sexual practices.

Pathology.—On excision of the bubonic mass, it will be seen to be composed of enlarged glands, indurated, or with multilocular areas, of softening, thickly adherent by an extensive periadenitis. On section, the glands show a diffuse hemorrhagic inflammation early, with a tendency, as the disease advances, toward changes in the direction of softening and abscess formation. The abscess formation may be a single cavity in a gland, but is characteristically seen as separate multiple necrotic islets of microabscesses throughout the gland structure. This is very characteristic, almost a pathognomonic pathology. The cell picture has giant cells, plasma cells, small lymphocytes and monocytes, large mononuclears, neutrophilic, eosinophilic, and basophilic cells. Late in the disease, the cellular elements become less numerous, and there is an increase in the fibrous connective tissue.

Clinical course—Inguinal type.—The primary lesion, as in syphilis, represents the inoculatory site for the entrance of the virus. It usually appears in 3 to 30 days after the infective contact. The lesion is frequently overlooked, as it is in many cases, quite small and insignificant. A thorough search will, however, disclose, in most cases, a small herpetiform vesicle or shallow ulcer, annular or crescentic in outline, usually surrounded by an erythematous zone. There is no induration, and it is usually painless and nonitching. In size, it is not much larger than a pin's head and rarely attains a diameter of 5 millimeters. It is usually located, in the male, on the prepuce or coronal sulcus, but may be on any part of the penis. An intraurethral location has even been described, with the production of a urethral discharge, in which no bacteria can be found, unless complicated by a secondary infection. In this connection, cases of urethritis of cryptic or doubtful origin, that are met with in urological practice, such as are described by Barbeillion (17), and Hissard and Husson (18), might well be Frei tested. In the female, the primary sore is generally located at the fourchette or on the posterior vaginal wall. Several extragenital infections have been recorded. Bloom (19), in 1933, described an undoubted case of lymphopathia venereum, with the primary lesion on the tongue, and associated cervical lymphadenopathy. The primary lesion usually heals spontaneously in a few days. The scar is correspondingly small and often indistinguishable after the lapse of 3 or 4 weeks.

Shortly after the appearance of the primary lesion, a regional lymphadenopathy develops. The adenopathy may be slight, in some cases, but is usually quite large, involving a whole group of inguinal glands. Initially, the glands are discrete, painful, and indurated, but, as the disease progresses, the glands become less painful and

are fused into one mass. The overlying skin, at this point, is usually adherent and of a cyanotic or violaceous hue. There is a distinct and marked periodontitis, with much connective tissue proliferation. Softening of the mass may then occur with suppuration. Suppuration takes place in the majority of cases when the gland enlargement is considerable, though resolution does occur even in these cases. A considerable number of the smaller lymphadenopathies show regression without proceeding to suppuration. The characteristics of lymphogranulomatous suppuration is quite typical of the disease. Breaking down of the gland mass takes place at various parts of the swelling with the establishment of a number of sinuses. These sinuses show no ulceration about them, but healing is delayed and often may not take place for months. The discharge itself is a thick, yellow-white, or even greenish tenacious pus.

Variable constitutional symptoms usually accompany the beginning involvement of the lymphatic glands. These include malaise, fever and sweats, anorexia, sometimes loss in weight, frequently nausea and vomiting, and a variable degree of prostration. Occasionally, there is articular swelling and skin eruptions; erythema nodosum being most frequently recorded.

Anorectal type.—This includes inflammatory conditions of the anus, rectum, and sigmoid, productive of a purulent or sanguino-purulent discharge, inflammatory stricture of the rectum, fistula-in-ano, rectovaginal fistula, and periproctical abscess. This syndrome is a later manifestation of lymphopathia venereum infection and is seen preponderantly in women, particularly colored women. It is believed that the higher incidence in the colored race is due not to a particular susceptibility of that race, but to the fact that venereal diseases in general are more prevalent among negroes than among whites. As for the particular prevalence of the anorectal type of the disease in women, the reason for this is an anatomical one. The primary lesion, in the female, is located most often on the vulva or on the posterior vaginal wall. The lymph drainage of these sites is by way of the anal region, and since the chief lymphatic networks are just within the anal canal and at the anorectal junction, it becomes apparent why the majority of inflammatory strictures of the rectum due to the virus of lymphopathia venereum are situated at these two locations—2 and 6 centimeters above anus. The anorectal syndrome has been observed for a long time, but its etiological understanding has been confused. Syphilis, gonorrhea, tuberculosis, or some other specific infection has been held responsible, but this issue has been settled by the use of the Frei test, and the definite demonstration that such a syndrome followed infection with the virus of lymphopathia venereum. It is interesting to note that cases of lymphogranulomatous rectal stricture occurring in the male, usually follow direct infection

of the rectal mucosa by sodomy or pederasty. I have been informed by Dr. A. W. Grace of the New York hospital that about one-half of the anorectal cases at that hospital are white men.

Elephantiasis syndrome.—This includes the chronic hypertrophic elephantiasis and ulceration of the vulva, also known as esthiomene, and elephantiasis of the male genitalia. This syndrome like the anorectal involvement is another manifestation of the effect of the virus of lymphopathia venereum. The elephantiasis hypertrophy is considered to be an outcome of the lymph blockage associated with the lymphatic involvement. The elephantiasis with ulceration is most often seen involving the labia majora and less often the labia minora and clitoris, giving the latter a "stalked" appearance, as has been described.

Elephantiasis of the male genitalia is not encountered as frequently now as formerly, due to the fact that extensive surgical excision of involved glands is rarely resorted to now. In the past, this surgical procedure was chiefly responsible for elephantiasis of the male genitalia. Occasionally, however, there is an edematous infiltration of the penis and scrotum, thought to be due to the presence of the virus setting up an inflammatory process.

Diagnosis.—The Frei test constitutes an invaluable supplementary aid in differentiating the inguinal lymphadenopathy due to the virus of lymphopathia venereum from infections with the treponema pallidum, the gonococcus, Ducrey's bacillus, B. tuberculosis, B. tularensis or simple pyogenic organisms or neoplasms. Originally the Frei test (12) as described by Frei, consists in the intracutaneous injection of 0.1 cubic centimeter of lymphogranulomatous antigen prepared from pus from an inguinal bubo of lymphogranulomatous origin, the pus being diluted 1 in 10 in physiological saline solution and heated at 60° for 2 hours on 1 day and for 1 hour on the following day. In individuals with lymphopathia venereum, a positive reaction is exhibited at the end of 24 hours, which reaches its height in 36 to 72 hours. This consists in the development of a red papule 6 millimeters to 1 centimeter in diameter, with a variable zone of erythema surrounding it. In more severe reactions vesicles or even pustules may succeed the papule, but this is infrequent. The papule shows regression by about the fourth day, disappearing entirely in about a month. In some cases, a macular pigmentation persists in the inoculated area.

The Frei reaction is interpreted as an allergic phenomenon of sensitivity to the virus of lymphopathia venereum. It is usually present 1 week following infection, but may be delayed for 2 weeks following the appearance of the primary sore. Once positive, it may persist for many years, perhaps for life.

A recent modification of the Frei antigen is the use of lymphogranulomatous mouse brains, obtained according to the method of Grace and Suskind (20) from the intracerebral inoculation of the virus of lymphopathia venereum into white mice, and prepared for intradermal use as the old Frei antigen. Grace and Suskind in studies, as yet unpublished, have transmitted the virus through 101 generations of white mice. They have shown that Frei antigens obtained from lymphogranulomatous mouse brains are specific, highly potent, and increase in strength with successive mouse passage. Strauss and Howard (21), have recently cast doubt upon the specificity and reliability of Frei antigens prepared from lymphogranulomatous mouse brains, for diagnostic purposes. This is at variance with the experience of other investigators in this field.

Treatment.—Prior to the use of Frei antigen as a therapeutic measure, numerous remedies were suggested for the treatment of this disease. Their number suggests their empirical basis and lack of specificity. Quinine, methylene blue, berberine sulphate, tuberculin, nonspecific protein therapy, X-ray, and other remedies have been used with varying and conflicting results. Ravaut (22), in 1921, was one of the first, if not the first to suggest the use of antimony preparations. A host of antimonials were tried including neostam, stibyal, fuadin, stebenyl, and others, besides tartar emetic. Many investigators in this field, however, feel, today, that these various antimonial products are valueless. Nevertheless, there are still many clinics in this country and abroad that use and advocate antimony.

Specific vaccine therapy was first tried by Delbet (23), in 1927. The vaccine was prepared by making an emulsion in saline of dehydrated excised portion of the gland mass. This was injected subcutaneously in increasing doses on alternate days until a total of 5 to 10 injections were received.

The latest form of specific vaccine therapy as employed at the New York hospital by Grace (24), consists in the use of Frei antigen obtained from lymphogranulomatous mouse brains. Beginning with 0.1 cubic centimeter subcutaneously, the dose is increased 0.1 cubic centimeter with each injection, until a maximum of 1 cubic centimeter is reached. The injections are continued at 1 cubic centimeter each until about 15 injections in all have been received. The injections are administered 72 hours apart. Good results are claimed with this plan of treatment as far as the inguinal cases are concerned. Unfortunately, comparable results are not attained, and neither can they be expected, in the later anorectal and elephantiasic syndromes, where considerable scarring and permanent tissue damage have occurred.



POSITIVE AND NEGATIVE FREI TEST.

Surgical procedures of incision and drainage are recommended when softening of the bubonic mass takes place. Massive excision of the involved glands has fallen into justifiable disrepute, because of the danger of elephantiasis.

N. S. P., a native Puerto Rican, private, United States Marine Corps, was admitted to the United States Naval Hospital, Brooklyn, N. Y., January 4, 1936, diagnosis—catarrhal fever. Symptoms on admission were chills and fever, malaise, anorexia, pains in the muscles and joints, and generalized weakness.

Past history.—No serious diseases, aside from syphilis acquired in 1931.

Physical examination.—Well-developed young adult. Weight 135 pounds, height 67 inches, temperature, 101°, pulse 96, respiration 20. Physical examination reported grossly negative on admission.

Treatment.—Bed patient, symptomatic treatment.

Clinical progress.—On January 6, 1936, 2 days after admission, patient complained of a swelling and pain in left inguinal region. Examination revealed an enlarged and indurated left inguinal bubo, tender to pressure. It was about the size of a walnut, comprising several separate nodes. A small pimplelike lesion was also discovered on coronal sulcus penis. Darkfield examination was negative for *treponema pallidum*. Urinalysis was negative. A complete blood count on January 8, 1936, showed red blood count 4,430,000, hemoglobin 85 percent, white blood count 9,600, neutrophils 55 percent, (band forms 5 percent, segmented 50 percent), lymphocytes 41 percent, eosinophils 1 percent, basophils 1 percent, and monocytes 2 percent. Kahn blood test was negative.

The temperature chart revealed a remittant type of fever, with morning elevations and evening depressions. During the first 5 days of hospitalization, the daily maximum temperature ranged from 103° to 100.4°, following which the height of the daily pyrexia was almost constant at 100°. On January 17, 1936, 13 days after admission, the temperature became normal and remained so.

In the meantime the left inguinal adenitis had progressed to a considerable size, being about 12 centimeters in diameter. On January 18, 1936, patient was transferred to urological service for further study and treatment. At this time there were no constitutional symptoms present. In the left inguinal region there was a large mass of inguinal adenitis, comprising several fused glands and a considerable periadenitis. The mass was not tender to pressure, but indurated in consistency. Penile lesion previously described in coronal sulcus dorsally was reduced to a small scar. Questioning elicited the information of sexual intercourse with a negress at Norfolk, Va., on November 6, 1935.

A Frei test was performed on January 21, 1936, which proved positive (fig. I), the height of the reaction being reached in 36 hours. Another patient in the ward not suspected of having lymphopathia venereum was subjected to a Frei test simultaneously, as a control. In this latter patient, the test was negative (fig. I).

In a consultation with Dr. A. W. Grace, who saw the patient at the New York hospital, specific vaccine therapy was instituted, using lymphogranulomatous mouse brains. The gland mass has shown constant though slow regression since first treated, with no evidence of suppuration.

The interval between the infective intercourse and the discovery of the primary lesion and associated lymphadenopathy was approximately 2 months in this case. The outside limit of the incubation period is generally given as 1 month. Whether this case represents an atypically long incubation period, or the primary lesion was merely overlooked for a month or more cannot be definitely stated.

When the diagnosis was changed from catarrhal fever to lymphogranuloma inguinale (using the older terminology), the reason for change was stated as "concurrent", although, I believe, it would have been more accurate to signify "error", as the reason for change. The symptoms of which the patient complained upon admission were probably the constitutional symptoms of invasion at the time of the beginning adenitis, rather than those of catarrhal fever, which they simulate, although, of course, he might have had catarrhal fever also. The long duration of the fever (13 days), suggests that, in all probability it was not catarrhal fever.

As regards the clinical improvement noted thus far under specific vaccine therapy, it is difficult to state just what part of such improvement is the treatment responsible, and what part may be due to spontaneous regression. It would appear, however, that this form of sensitization therapy is a rational one, and should definitely hasten resolution and healing in the inguinal type of the disease.

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PNEUMOCOCCUS SEPTICEMIA COMPLICATING PERITONSILLAR ABSCESS WITH SPECIFIC SERUM THERAPY¹

By JAMES J. V. CAMMISA, Lieutenant, junior grade, Medical Corps, United States Navy

Within a comparatively short period of time more than the usual seasonal incidence of prevalent pneumococcal infections have been noted among the admitted clinical cases of this hospital. Complications have also arisen and amongst them the present case of peritonsillar abscess, complicated by septicemia, due to type II, pneumococcus, successfully treated by the early use of specific sera both locally and intravenously, is worthy of reporting.

With or without surgical drainage and appropriate medical treatment specifically indicated type and convalescent sera have been successfully administered to combat septicemia complicating traumatic osteomyelitis, acute infectious peritonitis, scarlet fever, periperal fever, type 1 and 2 pneumococcus, lobar pneumonia, and various other clinical entities (1).

The advent of specific serum therapy in type one and two pneumonia has resulted in a most dramatic reduction of the mortality figures (2).

Septicemia may be regarded as an ever-present possibility in anginal sepsis which progresses to abscess or pus formation and requires surgical intervention. Consideration must be given, therefore, to a wider application of serum therapy to attack this problem especially in cases where a specific-type organism can be detected and a specific-type sera made available whenever indicated. On our services specific-type sera, their availability, and early indications are always kept in mind at the bedside in order to combat the local infection and limit localization of a general blood infection.

¹ Presented before the Escambia County Medical Society meeting held Dec. 10, 1935, U. S. Naval Hospital.

The case being presented was treated by the local use and intravenous injection of specific sera. Case history is as follows—

Age 25 (male) born Mississippi, was admitted September 11, 1935, complaining of "sore throat." Present illness began September 9, 1935, with onset of sore throat after exposure to inclement weather. Fever, chills, headache, and difficulty in swallowing set in the following day. Acute throat pain was felt with every effort to talk. Temperature was 103° F., pulse 120, and respiration 20. Physical examination presented flushed face and skin, moist and hot to touch. Both tonsils were acutely inflamed, showed a severe parenchymatous tonsillitis without membrane or exudate but with marked edema involving the anterior pillars and adjacent pharyngeal follicles. The submaxillary glands on both sides were tender to palpation but not enlarged. No rash was present anywhere on the skin. Chest, heart, lungs were normal. Blood pressure was systolic 110, diastolic 80. Laboratory examinations: Tonsil cultures were negative for diphtheria and Vincents organisms. Blood Kahn and urinalysis were negative.

Following symptomatic treatment improvement was noticeable the next day, but on September 13, 1935, he appeared toxic, drowsy, and was unable to swallow. Within 12 hours bilateral peritonsillar abscesses pointed in the supratonsillar areas. September 14, 1935, temperature was 101.8, pulse 104, and respiration 20. Both pillars were fluctuant, were incised and sero-purulent contents evacuated with considerable relief of local pain. Drainage was maintained. Smears from the pus evacuated yielded pneumococci which were identified as type II by the Neufeld method. The blood picture showed a white blood cell count of 26,600, bands 28 percent, segmented 58 percent, lymphocytes 8, and monocytes 6 percent. The general symptoms persisted and 40,000 units of Feltons' type I and II (combined) antipneumococcus serum was administered intravenously.

This was followed by definite improvement within 24 hours and the temperature dropped to normal but the dysphagia persisted. A 36-hour growth in the blood culture (taken at the time the serum was given) was positive for type II pneumococci. On September 17, 1935, marked improvement continued, swallowing and ability to talk without pain were possible. Temperature was 99.2, pulse 66, respiration 18, 10,000 units of Feltons' combined type I and II antipneumococcus sera were injected intravenously. The abscess cavities were packed with gauze soaked with this antisera for its local bacteriocidal effect. These were removed after 24 hours.

Convalescence was well established September 20, 1935. The leucocyte count showed a recession of the left shift. Total white count 9,000, bands 5 percent, segmented 66 percent, monocytes 5 percent, and eosinophiles 3 percent. The tonsillitis rapidly subsided and incisions healed. Tonsillectomy was recommended and the patient set to duty September 26, 1935.

About 2 percent of cases of acute tonsillitis are complicated by peritonsillar abscesses (3) usually within 4 days from onset and are indicated by an increased severity of the local reaction and toxic general symptoms.

Septicemia is more likely to occur in those cases in which too early or too extensive laceration of tissues over a focal point is done in an effort to insure adequate drainage.

When surgical intervention is delayed in cases of frank intracapsular abscess, considerable pressure is exerted by the accumulating pus within the tonsillar space. This ultimately forces infectious

material to rupture on the surface or involve and rupture through the tonsillar capsule into the peritonsillar tissues. It is during this stage that phlebitis of the tonsillar veins occurs followed by extension to larger veins with progressive phlebitis and the dissemination of septic emboli into the general circulation (4). Septicemia or localization in distant organs then becomes inevitable.

The mortality from septicemia complicating angina, septic sore throat or in cases often described as "fulminating" peritonsillar abscess still remains at 80 percent. That following acute pelvic cellulitis-acute infectious peritonitis-traumatic osteomyelitis and scarlet fever, although slightly lower and between 67 and 70 percent is still much too high a figure (5).

Can this appalling mortality be lowered? Kolmer and Scott (6), (7) emphasize "bolstering the immunologic resistance" in these cases by the timely administration of specific immune serum thus increasing the bacteriocidal activity of the protective antibody, promoting phagocytosis, and also compensate for complement deficiency in the blood stream.

In this case serum was administered early viz, 36 hours before the pus and blood cultures were returned as type II pneumococcus. The Neufeld reaction (8) applied to pus smears from the peritonsillar abscesses demonstrated that type II pneumococci were in pure culture in these preparations, and that this specific antisera was indicated. This reaction, while still considered by many as inclusive, has proven an excellent and trustworthy guide in classifying the groups of pneumococci for which specific antisera has been developed. This so-called Quellung reaction or capsular swelling of the pneumococcus organism is more reliable when applied to cultures and sputum obtained early in the disease. The immediate determination of type is a decided advantage over the mouse typing method since indicated sera can be given early, and in so doing the prophylactic and therapeutic value is considerably enhanced.

The early intravenous injection of the indicated type antipneumococcus serum in local processes due to that particular organism confers a passive immunity just as diphtheria antitoxin acts in that disease. Increasing dosage may be required to successfully overcome an already established septicemia.

In this case dosage was regulated by the clinical signs, blood picture, and local signs of subsidence of the inflammation in the throat.

Kolmer further stresses that immune sera administration should not be delayed in staphylococcic and streptococcic septicemias because these sera are primarily prophylactic and "do not cure damaged tissues but protect those tissues still unaffected." Specific serum therapy is also strongly recommended in sepsis following mastoid operations.

Rothchild (9) urges the use of specific antisera in otitic infections which give rise to type I and II pneumococcus complications.

Cadham (10) reports a mortality of 15 percent in a series of 100 cases of streptococcic and staphylococcic septicemia arising from various original foci. In a separate series of 15 cases his mortality was 10.5 percent but in 5 cases of subacute bacterial endocarditis, all died in spite of serum administration. His treatment combines immune rabbit antisera with normal human blood serum to supply additional complement.

Many clinicians require a positive blood culture prior to administering specific sera in the treatment of septicemia, a requirement that limits their use of this therapy to a group of cases in which laboratory facilities are available. Even in these cases some blood cultures will be negative for bacteriological growth yet at autopsy yield a growth from blood cultures taken from heart's blood (11).

Thus such procedures as the Neufeld reaction are a step forward toward the development of similar diagnostic aids where other organisms are concerned.

For the more extensive application of specific serum therapy in septicemia cases there is an apparent need for more diagnostic facilities as well as cooperative agencies which would supply the indicated serum to indigent cases outside of hospital practice.

In the control of lobar pneumonia Heffron and Anderson (12) have demonstrated the value of extending diagnostic and therapeutic aids as well as supervisory control to local physicians through the medium of the State Public Health Department. For the proper control of septicemia similar cooperative action by all public health units and diagnostic centers should be considered on a larger and more selected scale.

SUMMARY

1. A case of type II pneumococcus septicemia complicating peritonsillar abscess treated by specific antisera is presented.
2. The value of the early administration of this serum is stressed.
3. A wider application of specific therapy in septicemia requires cooperation of public health laboratories for diagnostic purposes and the procurement and distribution of specific sera as well as its supervisory administration and control.

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IMMOBILIZATION OF FRACTURE OF THE CLAVICLE BY MEANS OF PLASTER OF PARIS

By ROBERT E. BAKER, Lieutenant, Medical Corps, United States Navy

The treatment of fracture of the clavicle is fairly well standardized and there is customarily good union obtained by the usual methods of treatment. There have been numerous types of apparatus and various dressings devised and described for the treatment of this fracture. Perhaps each one is satisfactory in the hands of its special advocates but I have found some modification of the clavicular cross, or T-splint, most convenient for my use.

I do not like the Velpeau dressing or any modification of it. I have tried Cotton's method of omitting the lower, vertical portion of the T-splint but I do not believe this to be as satisfactory as the complete T. The lower portion does, in my opinion, have a definite value in maintaining the crossbar at the proper position and adds stability to the splint. Without the vertical portion, the cross bar, in my experience, tends to ride too high on the shoulders and does not give the steady security obtained with the entire splint.

The usual manner of application of this splint is by the use of adhesive strapping, roller bandages, or a combination of the two, applied over cotton padding. There is inevitably a certain amount of "give" in such a dressing which leads to the necessity of frequent replacements and tightening up procedures. In addition to this factor, there is also a tendency toward the production of pressure ulcers of the skin at the points where the tight straps cross the axillary folds.

Several years ago I described, in this section, a canvas, sleeveless jacket which laced in the back, and which I devised (with the help of the sailmaker) for use in maintaining elevation and retraction of the shoulders. This jacket was put on over the T-splint and gave

very satisfactory results with a minimum of inconvenience in dressing changes. I still consider this type of dressing superior to the usual one, but on shore duty the required cooperation of a sailmaker is not so easily obtained.

The idea occurred to me that a figure-of-eight plaster of paris dressing might be substituted for the usual adhesive and bandage material and with a recent case, I had the opportunity of trying it out.

After padding the splint well, cotton strips were placed between the skin and the splint and completely around the axillae and shoulders. Plaster of paris bandages were then applied in a figure-of-eight type dressing, the shoulders being held tight against the splint by an assistant. The accompanying illustrations will give a fairly good idea of the size of the axillary, and other portions, of the cast.

In addition to obviating the necessity for frequent dressing changes and "tightening" procedures, the cast was found to be much more comfortable by the patient. This, I believe, was due to the elimination of the sagging which occurred with the previous dressing due to slipping of the adhesive and stretching. The cast gives a firm, steady, and secure method for application of the T-splint.

I have found that a wide strip of muslin, secured to the lower portion of the splint with adhesive and held in place with long adhesive straps (see illustrations), gives a satisfactory anchorage. This band cannot be applied too tightly, however, because of pressure upon the abdomen.

I believe the above to be a useful addition to the ordinary method of immobilizing clavicular fractures.

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REPORT OF AN UNUSUAL CASE OF ABNORMAL DENTITION

By Charles F. Hoyt, Lieutenant, Dental Corps, United States Navy

Patient, R. L. C. R., age 31, white. Oral and X-ray examination revealed the following:

Upper right.—First and second molar in position. Third molar missing. Three bicuspid, one impacted. Cuspid normal, no laterals, central normal.

Upper left.—Central impacted in labio-version to roots of upper lateral incisors. Three lateral incisors in position, cuspid and first bicuspid normal. Second bicuspid extracted in 1935. Balance of teeth missing.

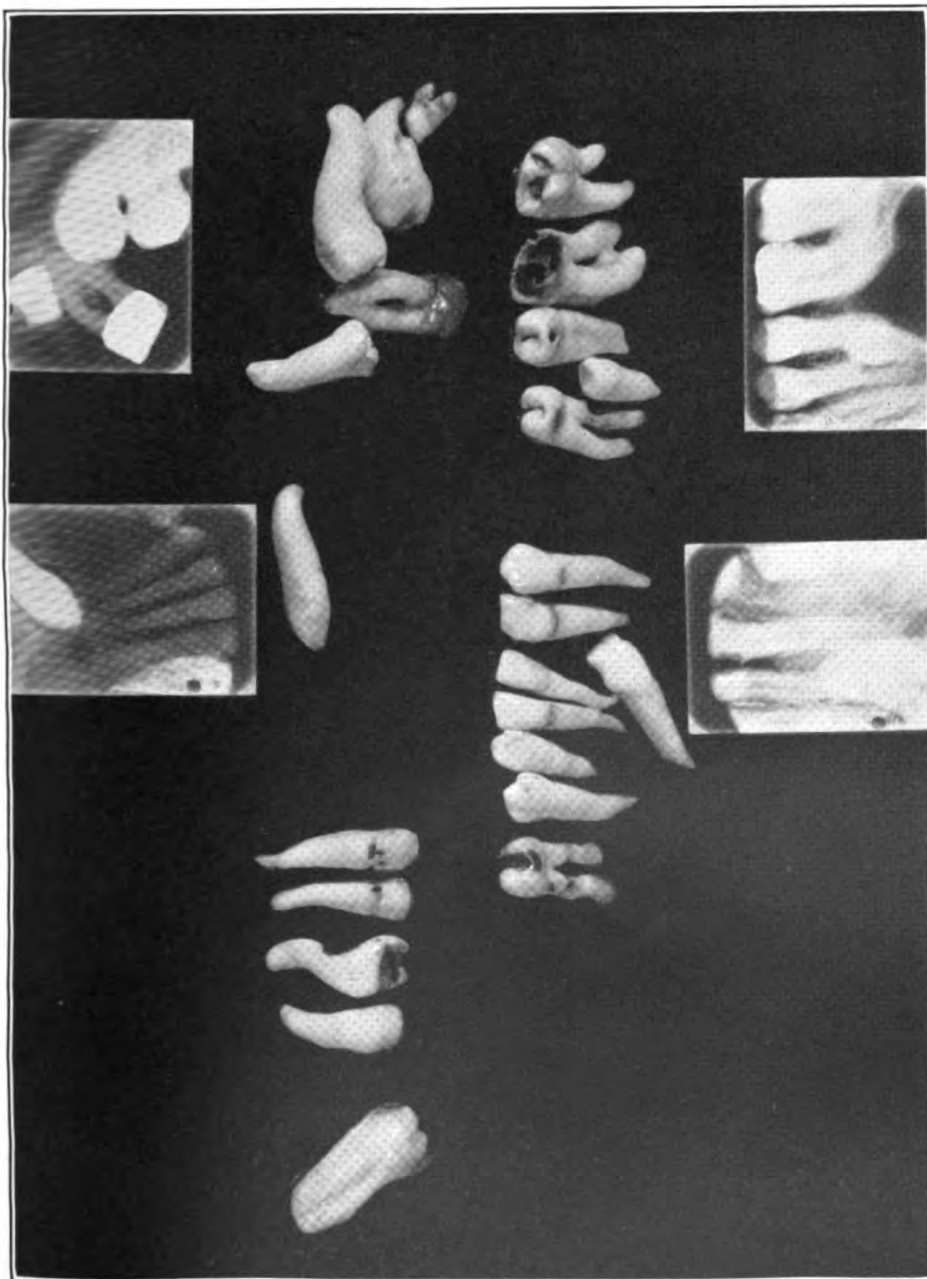
Lower right.—Third molar erupted in horizontal position. Second molar horizontally impacted, first molar normal except for lack of supporting structure. One bicuspid impacted at apical third of the molar. One bicuspid in position and record of the extraction of two more bicuspid, one in 1925 and one in 1929. Cuspid horizontally impacted at apices of lower centrals. Centrals normal.

Lower left.—Centrals normal position, cuspid normal. Three bicuspid in position and record of the extraction of a fourth in 1927. First molar extracted in 1934. Second molar in position. Third molar missing in 1925 on entrance to service.

There is record of the removal of additional supernumerary tooth with no reference to location. It is believed probable that it was a third bicuspid on the upper left side. The mouth was prepared for full dentures in five sittings over a period of 2 months.

SUMMARY OF ABNORMALITIES

- 5 impacted teeth.
- 4 bicuspid on either side, lower.
- 3 bicuspid on either side, upper.
- 3 laterals on upper left side.
- 0 lateral on upper right side.



This photograph shows the teeth after removal, arranged in the approximate position occupied in situ, together with insets of a few of the X-ray pictures.

NAVAL RESERVE

MEDICAL CORPS

PROMOTIONS, UNITED STATES NAVAL RESERVE, FIRST QUARTER, 1937

Lt. Comdr. Francois L. Hughes, M. C.-V (S), U. S. N. R. Promoted from lieutenant M. C.-V (S). January 22, 1937.

Lt. Joseph Fulcher, M. C.-V (G), U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-V (G), U. S. N. R. January 21, 1937.

Lt. Glenn G. English, M. C.-F, U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-F, U. S. N. R. March 11, 1937. 911 Taft Building, 1680 Vine Street, Hollywood, Calif.

Lt. Robert V. Schultz, M. C.-F, U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-F, U. S. N. R. March 16, 1937. 7 Pine Street, Belmont, Mass.

Lt. Lloyd T. Sussex, M. C.-V (S), U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-V (S). February 25, 1937. 315 Second Street, Havre, Mont.

Lt. George W. Tarry, M. C.-F, U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-F, U. S. N. R. March 15, 1937. 405 Blackhawk Street, Chicago, Ill.

Lt. Burt O. Wade, M. C.-V (G), U. S. N. R. Promoted from lieutenant (jr. gr.), M. C.-V (G), U. S. N. R. March 13, 1937. Waimea, Hauai, Territory of Hawaii.



JAMES RUFUS TRYON.
Surgeon General, United States Navy, 1893-97.

NOTES AND COMMENTS

JAMES RUFUS TRYON

Surgeon General, United States Navy, 1893-97

The tenth Surgeon General, United States Navy, and the fourteenth Chief of the Bureau of Medicine and Surgery, James Rufus Tryon, was one of the most outstanding incumbents of the office. He was born in New York on September 24, 1837, and graduated from Union College at Schenectady with the degrees of B. A. and M. A. He received his medical degree from the medical school of the University of Pennsylvania in 1861, and was appointed an assistant surgeon in the Navy from New York on September 22, 1863, and assigned to the West Gulf Squadron. He was landed at the naval hospital, Pensacola, Fla., in charge of the wounded from the Battle of Mobile Bay and was later ordered to make a special report to the Navy Department on the wounded treated at Pensacola during the war. He was an assistant to the Chief of the Bureau of Medicine and Surgery from 1866 to 1870, and is believed to be the officer who, with the assistance and encouragement of the Chief of Bureau, Surgeon General P. J. Horowitz, prepared the manuscript, and still unpublished medical and surgical history of the Navy in the Civil War. Attempts to obtain funds from Congress for the publication of this report, which was to parallel the medical and surgical history published by the War Department, failed; and the manuscript has since been lost, and all attempts to locate it been without avail.

Tryon's next service was on the Asiatic Station, where he had charge of a temporary smallpox hospital at Yokohama, Japan, during an epidemic of that disease there in 1871, and was ordered by Rear Admiral John Rodgers, then in command of the station, to superintend the construction of the naval hospital, Yokohama, commenced in 1872 and destroyed by the earthquake of 1923.

His subsequent service included experience in a yellow fever epidemic at Pensacola; duty in the North Pacific Squadron; member of the Examining Board at Philadelphia; and delegate to the International Medical Congress at Copenhagen, Denmark, in 1884. He was also fleet surgeon of the newly built and famous White Squadron. He was promoted to passed assistant surgeon in 1866, surgeon in 1873, and medical inspector on September 22, 1891. He was appointed Chief

of Bureau, with the rank of commodore on May 10, 1893, by President Grover Cleveland and held this office until 1897. Surgeon J. D. Gatewood was his Assistant Chief of Bureau. His broad background of naval life and experience, combined with high abilities, made his appointment as Surgeon General an important one for the Naval Medical Corps.

He at once revived the old Naval Laboratory at Brooklyn, renamed it the "Naval Laboratory and Department of Instruction" and began the practice of sending newly commissioned medical officers to it for a preliminary course of postgraduate instruction in naval medicine before sending them to sea or general duty. In 1894, when the new Naval Observatory was constructed on the present Massachusetts Avenue site, he secured the old Observatory building and moved the school into it. At the same time, he established there the Museum of Naval Hygiene, in charge of Medical Director A. C. Gorgas. During Tryon's administration, the subjects of naval medicine and naval hygiene were given emphasis as matters of importance to naval medical officers, and the new knowledge of preventive medicine rapidly applied to the problems and needs of the Navy. Tryon urgently recommended the addition of a hospital ship to the fleet; the creation of a hospital corps; and increase in the number and rank of naval medical officers, the building of additional naval hospitals and the establishment of a medical supply depot. Many of these advances did not come until the administration of Surgeon General Van Reypen, when the stimulus of the Spanish American War produced the needed impetus to the medical departments visualized and urged by Tryon.

His whole administration was marked by clear and farsighted policies beneficial to the Navy, and when all the plans and projects advocated by him are considered in their true historical perspective it may be said that with the exception of Rixey he was the ablest of the Surgeons General the Navy has had. Surgeon General Tryon was a man of fine appearance and courtly manner. He was a bachelor, possessed of independent means, and with an excellent knowledge of good food and good wines. When Surgeon General, invitations to his dinners were eagerly sought by members of Washington Society.

Tryon received the honorary degree of doctor of laws from his alma mater in 1891. He retired on September 24, 1899. The last years of his life were spent at Coxsackie, N. Y., where his death occurred on March 20, 1912. Recently Union College has placed a portrait of Surgeon General Tryon in its gallery of distinguished graduates and has prepared an official biographical sketch of him.

ARTICLES OF SPECIAL MERIT PUBLISHED IN THE NAVAL MEDICAL BULLETIN IN 1936

It has been customary for a number of years for a board to select from the articles published in the NAVAL MEDICAL BULLETIN during each calendar year, those having special merit. The writers of articles thus singled out then receive from the Surgeon General a letter of appreciation which, of course, is highly valued by the recipient and may be made a part of his official record. In recent years the Postgraduate Board has exercised the function of selecting these articles. In 1936 the following authors were selected to receive special letters from the Surgeon General:

1. Lt. Comdr. E. G. Hakansson, (M. C.), United States Navy. Observations on Chromatoid Bodies in the Cysts of *Entamoeba Histolytica*. October 1936 BULLETIN.
2. Lt. Comdr. W. W. Hall (M. C.), United States Navy. Drunkenness: Naval Medico-Legal Aspects of this Diagnosis. April 1936 BULLETIN.
3. Comdr. Frederick R. Hook (M. C.), United States Navy. Ventral Hernia as a Sequel of the Traumatic Abdomen. October 1936 BULLETIN.
4. Comdr. J. H. Chambers (M. C.), United States Navy. Review of the Pathology Observed in 1,018 Post-Mortem Examinations in Haiti. July 1936 BULLETIN.
5. Lt. (Jr. Gr.), L. E. Gilje (M. C.), United States Navy. Lymphogranuloma Inguinale and Climatic Bubo. January 1936 BULLETIN.

THE USE OF GLYCERINE IN MEDICINE

Glycerine was discovered by the great Swedish pharmacist, Karl Wilhelm Scheele, in 1780, now nearly 157 years ago. Time has shown the tremendous importance of this discovery in all fields of science, and particularly in medicine and pharmacy. A recent study made by Milton A. Lesser, a research chemist, and John R. Murphy, M. D., entitled "Glycerine: Its Role in Medicine" and published in the American Professional Pharmacist, shows that it is employed in many specialized fields of medicine including gynecology, therapy of varicose veins, endocrinology, surgery, anaesthesia, and in dentistry. The survey showed that of 194 galenicals listed in the United States Pharmacopoeia XI, more than 12 percent contained glycerine, and in the National Formulary VI (N. F. VI), 16 percent of the 481 formulas listed contained glycerine. As a part of the national drug store survey an analysis of prescriptions shows that among chemicals, galenicals, and miscellaneous ingredients, in more than 15,000, except for distilled water, glycerine is the liquid most used.

The value of glycerine is largely derived from its unique properties as a hygroscopic agent, as a solvent, as a sweetening agent, emollient, and demulcent. Had Scheele made no other discovery in chemistry,

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the importance of the discovery of glycerine would have been such as to make him known as one of the most famous of chemists.

ANNUAL MEETING OF THE ASSOCIATION OF MILITARY SURGEONS

The next annual meeting of the Association of Military Surgeons of the United States will be held at Los Angeles, Calif., October 14, 15, and 16, 1937. The Hotel Biltmore will be the headquarters for the meeting.

This is the first time that the association has met on the Pacific coast and the fact that the Surgeon General of the Navy, Rear Admiral P. S. Rossiter, Medical Corps, is the president of the Association this year, together with the proximity of the Fleet, will no doubt greatly increase the Navy membership in the association and the Navy attendance at the meeting.

PRECIPITIN TEST FOR TRICHINOSIS

In dealing with possible cases of trichinosis among Navy personnel, it will be of interest to medical officers to know that they may have specific precipitin tests performed at the Naval Medical School in cooperation with Dr. M. C. Hall of the National Institute of Health, United States Public Health Service.

DIRECTIONS FOR COLLECTING SERA

1. All apparatus used for collecting specimens should be washed free of alkali and acid before sterilization.
2. Only sterile apparatus and solutions should be used.
3. Rinse syringe with physiologic saline to prevent emolysis.
4. Bleed the patient before breakfast to avoid chylous specimens and prevent deterioration enroute. About 10 cc should be taken.
5. Serum to be separated from the clot before hemolysis begins to take place and rendered perfectly free from red cells and particles by centrifuging—all steps under aseptic conditions.
6. Submit at least 2 cc of perfectly clear serum in sterile ampoule or sterile rubber-stoppered vial.
7. Do not heat or add preservative of any nature.
8. Send by air mail to the United States Naval Medical School.

Blood becomes positive between 20 and 30 days after ingestion of trichinous meat. Studies are being made however to develop a technique which shall give information at an earlier stage. It is therefore suggested that serum be taken on the seventh day following supposed date of ingestion for a presumptive test, and again on the twentieth day for the proved test.

In particular cases, freshly prepared extract of antigen for a confirmatory skin test will be forwarded upon request together with instructions for use.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The EDITOR, UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

WILLIAM WITHERING, *THE INTRODUCTION OF DIGITALIS INTO MEDICAL PRACTICE*, by *Louis H. Roddis, Commander, Medical Corps, United States Navy*. 131 pages; 8 illustrations. Paul B. Hoeber Publishing Company, New York. 1936. Price \$1.50.

Those who have had the privilege of reading Roddis' "Life of Jenner" are quite aware of the author's exceptional skill in collecting a large mass of authentic information on a subject, no matter how far and how difficult the search may be, and then piecing it all together in a readable and entertaining and still very precise form. He is the type of biographer, tremendously admirable and all too rare, who would rather spend a month in tracing down the veracities of some little biographical circumstance than allow his imagination to run away with the facts. The happy result is the production of a masterly sketch such as he has turned out in this study of Withering—compact, precise, authentic and delightful.

The story of Withering takes us into the inner circles of many of the notables of the late eighteenth century in the world of medicine and general science; Fowler, Priestly, Erasmus Darwin, James Watt, Josiah Wedgwood, Herschel and Benjamin Franklin, to mention a few of those with whom Withering came into close association.

The account of Withering's observations on the action of foxglove and his efforts which led to the introduction of this plant into universal medical use is a matter which should rank both in general interest and in medical historical importance with Jenner's contemporary work in smallpox prevention. Roddis, who is a recognized authority on both Jenner and Withering, draws many interesting parallels in the works of these two. The chapter on the foxglove work includes 15 pages of extracts from Withering's original edition (now selling at \$525) and all of Withering's original conclusions, or "inferences", as he calls them. These conclusions are especially enlightening when placed in comparison with the sets of conclusions ordinarily seen in modern medical literature. Withering has weighed every word so as not to

overstate the case, and every statement has the backing of the shrewdest observations and the most solid scientific evidence, exactly the sort of inferences and the style of their presentation we should expect from the mind of Withering, who had more scientific background than that of a mere eighteenth century physician. He was, in addition, a renowned botanist and mineralogist, a chemist of note, and a ceaseless worker with the indefatigability of a truck horse.

To this reviewer, one of the most pleasing, not to say prideful, things about the appearance of a book of this stamp is that it came from the pen of a member of the Navy Medical Corps.

THE DISPENSATORY OF THE UNITED STATES OF AMERICA. *Centennial (22d) edition.* Wood, LaWall, Youngken, Osol, Griffith, and Gershenfeld. 1894 pages. J. B. Lippincott Co.

This famous encyclopedia of drugs is now 104 years of age, the first edition appearing in 1833 when one of its editors was Mr. George B. Wood, a great uncle of the present editor, and as coeditor was Franklin Bache, the great-grandson of Benjamin Franklin. This first edition listed 4,800 titles. The present one lists 28,000 titles.

This great book has rendered service to many generations of physicians and pharmacists. In the more than 100 years of its existence over 300,000 copies have been sold. The present magnificent edition is an indispensable volume for the bookshelf of doctor, pharmacist, and scientist in the biological fields.

AUTOPSY DIAGNOSIS AND TECHNIQUE by *Otto Saphir, M. D., Associate Professor of Pathology, University of Illinois Medical School.* 342 pages, 65 illustrations. 1937. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York and London. Price \$5.

This manual of postmortem examination begins with such practical features as a clear exposition of the laws which govern the performance of autopsies and the necessary steps to obtain authority for such examination. Another valuable feature is the quotation from Hektoen's Post Mortem Technique which, as the author well says, has guided pathologists, at least in America, for more than 40 years. The careful description of technique and the survey of possible pathology is most helpful. This is an excellent little book, simple and practical, not cluttered up with nonessentials. Particularly valuable are the sections on anesthetic accidents.

SYNOPSIS OF DISEASES OF THE HEART AND ARTERIES, by *George R. Herrmann, M. D., Professor of Clinical Medicine, University of Texas.* 344 pages. 88 text illustrations and 3 color plates. The C. V. Mosby Company, St. Louis. 1936. Price \$4.

This is a short handbook of cardiology intended to supply to the student and general practitioner the essentials of the subject. The author felt that the larger textbooks such as those of White and Christian, and the numerous monographs, while indispensable for

reference work are sometimes too extensive and exhaustive for the busy practitioner. Doctor Herrmann has attempted to supply an epitome, brief and clear, which will give the practicing physician a source from which reliable information in regard to the diagnosis and treatment of heart disease may be had.

THE MANAGEMENT OF OBSTETRIC DIFFICULTIES, by *Paul Titus, M. D.*, 879 pages, 314 illustrations (4 color plates). C. V. Mosby Co., St. Louis, 1937. Price \$8.50.

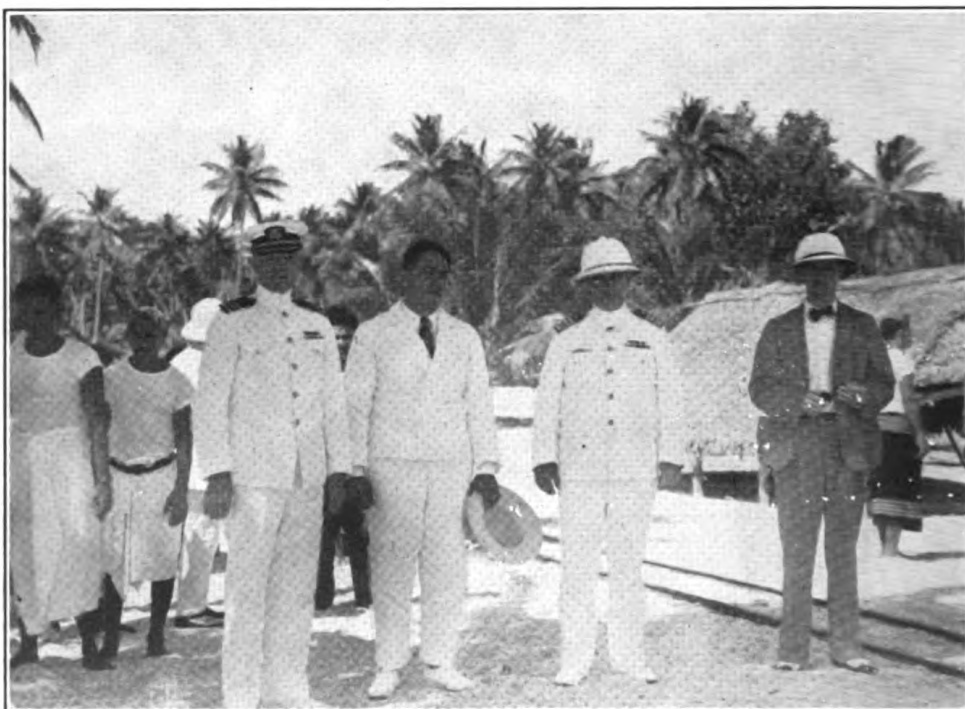
The term "difficulties" in the title allows for the inclusion of much material not necessarily emergencies, such as for instance sterility, which while not an emergency is certainly a serious difficulty to the obstetrician and gynecologist. In general, however, ectopic pregnancy, multiple pregnancy, dystocia, injuries, and placenta previa take up much of the space. A feature is the careful consideration given to many minor complications of pregnancy and the puerperal states often overlooked or scarcely mentioned but which are capable of causing much trouble to both patient and physician. Another feature is the space devoted to various diseases and their relation to the puerperal state. Methods of inducing labor, the use of the obstetric forceps and version are also valuable chapters, clear and practical in character. The illustrations, printing and binding of the book are splendid. Obstetrics may be said to be the specialty of the general practitioner and this book is eminently fitted to be his guide in many difficulties.

PRESCRIPTION WRITING AND FORMULARY, THE ART OF PRESCRIBING, by *Charles Solomon, M. D.*, Assistant Clinical Professor of Medicine, Long Island College of Medicine. 351 pages; with 32 illustrations. J. B. Lippincott Company, Philadelphia and London, 1936. Price \$4.

This is an excellent manual of prescription writing and has many excellent formulae. The illustrations, unusual in a formulary, are extremely valuable and practical.

DISEASES OF THE NOSE AND THROAT, by *Charles J. Imperatori, M. D., F. A. C. S.*, Professor of Clinical Otolaryngology, and *Herman J. Burman, M. D., F. A. C. S.*, Assistant Professor of Clinical Otolaryngology, New York Postgraduate Medical School, Columbia University. 722 pages. 480 illustrations. J. B. Lippincott Company, Philadelphia and London. 1936. Price \$7.

This book is intended rather for the general practitioner than the specialist and much attention is given to office procedure and treatment technique. While the symptoms, diagnosis and treatment are given first and the pathology and bacteriology last, these latter subjects are not neglected. Many of the illustrations, particularly those showing treatment and operative measures are original.



GOVERNOR OF SAMOA AND PARTY AT SWAINS ISLAND.

Left to right: Commander C. S. Stephenson, Medical Corps, U. S. Navy, public health officer; A. E. Jennings, owner of the island; Capt. O. C. Dowling, U. S. Navy, Governor of American Samoa; and E. C. Johnson, Chief Justice of American Samoa.

THE DIVISION OF PREVENTIVE MEDICINE

C. S. STEPHENSON, Commander, Medical Corps, United States Navy, in charge

SANITARY REPORT OF SWAINS ISLAND, 1934

By C. S. STEPHENSON, Commander, Medical Corps, United States Navy

The U. S. S. *Whipporwill* arrived at Swains Island Tuesday, May 22, 1934, at 0845. Mr. Eli Jennings came on board and reported that there were no contagious or infectious diseases on the island.

The main village and other parts of the island were found to be exceptionally clean. This is in marked contrast to the cleanest village of American Samoa. Rating Swains Island on a basis of 4, the cleanest village in American Samoa would receive the rating of 1. There was no refuse or stagnant pools of water on the island. The beaches were clean. There is a large lagoon of brackish water in the center of the island. Small fish in abundance are present in this body of water which may account for the very few mosquitoes found. The mosquitoes examined were of the genus *Aedes*—tentatively identified as *Aedes aegypti* and *Aedes pseudoscutellaris*. Considerable effort was made to find the breeding places of these pests, but since there had been little rain for several days no larvae were found. This was a disappointment, as it was hoped to find the larvae, breed them out, and thus definitely fix the identity of the mosquitoes of the island. The inhabitants of Swains Island insisted that they were never badly bothered by mosquitoes, but they report that mosquitoes are present in greatest numbers in the months of October and November.

Flies were found in considerable numbers. Specimens were taken for identity. They were considerably smaller, but marked almost identically as *Musca domestica*. They were about the most persistent flies the writer has ever seen. They were breeding in a small manure pile and advice was given for their control.

The water supply of Swains Island is rain water. This water is collected from various buildings which are covered with corrugated iron roofs. The water is led through a closed drainage system into sealed iron reservoirs. It is potable, of good quality, and reported to be sufficient for the needs of the population.

The writer has had considerable experience in other parts of the tropical world and was struck by the unusual use of coconut husks and other refuse. This refuse is carefully collected and stacked around

the roots of the banana trees. In addition to retaining moisture around these plants this serves the useful purpose of keeping the village and beaches clean, and upon final decomposition results in renewing the soil.

The inhabitants were found to be exceptionally healthy and well nourished. There was one suspicious case of crab yaws. This girl had come from Western Samoa. Fortunately Mr. Jennings had energetically carried on treatment with a mercurial ointment. No other cases of yaws were observed, nor was there any indication that this disease exists on this island. There was one case of filariasis. This patient is a native missionary who returned to Swains Island last year after spending 30 years in New Guinea.

The usual communal life—as observed in Samoa—is present. In addition, the interesting group of laborers imported from various islands is present. Of this group 30 are men and 18 women. They come to Swains Island, remain during their period of satisfactory service and leave when they no longer desire to remain in the employ of Mr. Jennings.

Work is divided in a most interesting manner. A portion of the laborers are constantly engaged in the various tasks necessary to life on an isolated island, while others are engaged in jobs necessary to run a coconut plantation of some 20,000 trees, 15,000 of which are bearing, and produced 120 tons of copra last year—almost the sole source of income to the island. The men are detailed in turn under the instruction of the most skillful fishermen present to engage in fishing for the daily needs of the island. One thousand eighty fish of one species (bonito) were taken during the last season. This appears to be the most prized fish and we neglected to ascertain the number of other species taken. The surplus fish is dried, or salted—thus there is no waste of food material. Numerous reports from both the owner and his laborers indicate an unusually abundant fish life on the reefs of the island. In fact Mr. Jennings has reported that if transportation were available he would be able to earn considerable money by catching and drying fish for export.

It is the custom to vary the ration of the laborers after the following fashion: Fish, with such other products as are available is fed on A day. On B day the ration is fresh, or salt pork, in addition to the above-mentioned articles of diet. One very delectable dish—Swains Island pudding—composed of very finely grated coconut and arrow root was served at the feast given by Mr. Jennings. This dish was flavored with crushed orange leaves.

Hogs and pigs to the extent of 200 animals were reported on this island. While the writer made no count—this appears to be a very liberal estimate. One of the oldest laborers remarked that he had

grown tired of pork, and wished it were possible to have sufficient cattle to vary the diet with beef.

While the poultry nominally belongs to the owner of the island it was noted that many chickens were tied to various foles (houses). Several of these hens were brooding flocks of young chickens. It is natural to expect inaccuracy in any native report, and the following estimate of one of the boys present was that there were more than 1,000 chickens on Swains Island. This is obviously an exaggeration. A bird resembling the snipe was seen in fair abundance. In addition rail were seen. Wild ducks occasionally rest on the lagoon. Mr. Jennings reports shooting game with a fair degree of regularity and this augments the diet of his own family and close associates.

Under the direction of Mr. Jennings salt is manufactured after the following manner: A shallow pot is used for boiling sea water. The boiling process continues about 3 days before the salt is finally ready for use. There is no effort made to produce pure sodium chloride. Naturally, the question of what effect this type of salt has on the health of the individuals is raised.

Mats are made from the leaf of the pandanus plant. These mats are fine in texture and quite durable. In addition, a hat—resembling the Panama hat—is manufactured from the native grass. The weaving is splendidly done and the hats are serviceable, but far too expensive for ordinary commerce. Some crude specimens of wood carving were observed. Naturally many work implements are manufactured from crude materials.

The houses of Swains Island are made after the type of the houses seen in other islands of the South Pacific. They are manufactured of such wood as it is available. This wood in most instances is of the hardwood variety, while the laths for the roof are of breadfruit wood. The houses are nailed together with copper nails rather than the intricate scarf-joints and binding with sennit as is common in Samoa, as well as other islands of the South Pacific. This is accounted for by the fact that the owner is a generous provider. The roofs of the houses are thatch made of pandanus leaves, whereas the roofs of the Samoan houses are thatched with sugarcane leaves. Mr. Jennings (owner) lives in a palagi (white man's type of construction) house. Around his house is a group of several box and frame structures. In these houses live his attendants and close friends.

While the following is not strictly medical material it does, however, have a collateral bearing from the economic status, which in turn has a most important bearing on the health of the people. The island is provided with a large copra shed. In this shed there is an open space on which is constructed a track. On this track is a carriage which can be rolled out to the sun for the purpose of drying the copra.

Should a sudden squall occur this drying copra may be quickly run under the shed and thus prevent damage. In addition, there is in this structure a large bin which contains an estimated quantity of 40 tons of copra. Around this shed was grouped numerous copra drying racks. They were latticed in construction and were provided with large sheets of corrugated iron which could be quickly put in place in event of rain. Not far from the copra shed was located the village cook house. This structure was much larger than those ordinarily seen in Samoa and was without doubt the cleanest and best kept cook house the writer has ever seen. In addition to this cook house each of the fales was provided with its own cook house, they too were remarkably clean. There is a very neat frame structure in use as a church and school. All the inhabitants of Swains Island are adherents of the London Missionary Society faith.

For a few houses sanitary privies were noted. The "beach latrine" is the usual practice. In this connection no excreta was found on the beach.

The present population of Swains Island is 111, tabulated according to the quinquennial age groups and sex as follows:

	Male	Female	Total		Male	Female	Total
Under 1 year.....	4	1	5	40 to 44 years.....	4	1	5
1 to 4 years.....	5	12	17	45 to 49 years.....	1	1	2
5 to 9 years.....	7	11	18	50 to 54 years.....	4	2	6
10 to 14 years.....	8	6	14	55 to 59 years.....	1	2	3
15 to 19 years.....	8	1	9	60 to 64 years.....	1	1	2
20 to 24 years.....	2	4	6	65 to 69 years.....	1	0	1
25 to 29 years.....	3	5	8	70 and over.....	0	0	0
30 to 34 years.....	5	3	8				
35 to 39 years.....	3	4	7	Total.....	57	54	111

There were six births, one death, one marriage, and no divorces during the past year.

It is interesting to note that there are 35 persons from the Tokelan Islands. Also, to note the difference in size of the average person as seen on Swains Island compared to the average size of the residents of the Samoan group

Every person on the island was seen by the writer and those with complaints or symptoms were examined and treatment prescribed. Written instructions were left with Mr. Jennings. It was rather amusing to have a perfectly able-bodied man request that his chest be "sounded", and to note his gleeful reaction when told that he was tele malos (quite strong and well). However, this is no exception to the general rule when free clinics are held for a group of primitive people.

The following diseases were observed and treated:

Disease	Number	Remarks
Arthritis, chronic.....	1	Treatment prescribed.
Abscess, arm.....	1	Treated.
Abscess, scalp.....	1	Do.
Bronchitis, chronic.....	1	Treatment prescribed.
Conjunctivitis.....	2	Do.
Constipation.....	2	Do.
Filariasis.....	1?	Do.
Fistula in ano.....	¹ 1	Do.
Gastritis, chronic.....	1	Do.
Hydrocele.....	¹ 1	Do.
Impetigo.....	4	Do.
Myocarditis, chronic.....	2	Do.
Myositis.....	1	Do.
Menopause.....	1	Do.
Otitis, externa.....	1	Do.
Ringworm.....	16	Do.
Tropical ulcer.....	1	Do.
Trichophytosis.....	26	Do.
Worms.....	1	Do.
Yaws.....	1	Doubtful.

¹ These cases were advised to return to the Samoan Hospital for operation, but declined.

The dental officer who accompanied the official party extracted 25 teeth under local anesthesia. This officer observed a remarkable degree of dental perfection amongst the natives of this island. This perfection pertains to all age groups. The Faife'au (pastor) gave the information that Swains islanders know nothing of mouth hygiene, and never use the primitive methods observed in Samoa for mouth cleanliness; that is to say, a frayed stick or crude tooth brush made from coconut fiber. Despite this lack of care there was an astonishing number of people without dental disease.

A yearly supply of medical stores at a value of approximately \$50 with proper instructions attached were delivered to Mr. Jennings. Mr. Jennings reports that the barium carbonate delivered last year greatly reduced the rat population. However, his supply of barium carbonate is exhausted and the rats are increasing. An effort will be made to provide him with another supply next year.

In former years it was estimated that 20 percent of the coconut crop was damaged by the ravages of rats. In addition to the supplies above mentioned considerable time was given Mr. Jennings to go over his medical stores and suggest the proper treatment for various conditions encountered by him.

HISTORICAL NOTE ON SWAINS ISLAND

By C. S. Stephenson, Commander, Medical Corps, United States Navy

The position of this island is longitude 170°55'15" West and latitude 11°05' South (1). It lies about two hundred miles north of Pago Pago, American Samoa.

It was discovered by Quiros on March 2, 1606 (2) (3) when he first called it Peregrina (2). The Memorial (1609) lists Peregrino and Torres called it Matanza. In Torquemada the name "Gente Hermoso" is given (2). It was called Gente Hermoso because of the beautiful people (2) who were described as "the most beautiful, white, and elegant people that were met with during the voyage" (3).

It has also been known by many other names, amongst them Quiros Island after its discoverer.

An old trader, Capt. Joseph Stephany, of German extraction and a naturalized American citizen, long a resident of Samoa, always spoke of it to the writer as Quiros Island, although to others he explained that he meant Jennings or Swains Island. It is worthy of note that Captain Stephany was for many years a trader in the islands of the South Pacific and knew Eli Hutchinson Jennings, the father of the present owner. It is due to the lead given by Captain Stephany that a manuscript, translated from the Tokelau language, was loaned to the writer by the present owner of the island, E. A. Jennings. From this manuscript we learn that this island has for years been known by its residents and American Samoans as Olosega, despite the fact that there is an island of the same name in the Manu'a group, which is a portion of American Samoa. Many of the people of Western Samoa (New Zealand mandate) speak of it as Jennings Island, after the owners.

Numerous charts have been examined and the majority of them carry the name Gente Hermoso. A United States Hydrographic Office chart, dated as late as October 1925, carries that name (4). It is now known as Swains Island, the name given to it by Captain Hudson of the United States Exploring Ship *Peacock*, in honor of the master of a whaling ship who had informed him of its existence.

Hudson states that he visited it on January 31, 1840 (1) (5). Lieutenant Wilkes, United States Navy (6) however, reports the date to be February 4, 1840. Hudson's account as reported by Wilkes (1) points out that the position differs from that given by Quiros, but it should be remembered that in older observations great discrepancies occurred, and the South Pacific Directory holds that it is "no doubt the same as Gente Hermoso Island of Quiros" (5).

Wilkes (1) writes of it as follows:

"* * * Boats were sent to effect a landing, but the surf was found to be too heavy, and one that approached too near was caught in the rollers and thrown on the coral reef, fortunately without harm to any of the crew. The boat, however, was somewhat injured. * * * It is of coral formation, but has no lagoon. It is nearly round, and four miles and three-tenths in circumference; it may be classed with the high coral islands, and is elevated from fifteen to twenty-five feet above the sea; it is well wooded with cocoa-nuts, pandanus, and other trees and shrubs. The sea breaks constantly on all parts, and no safe landing exists * * * When within a mile of the island no bottom could be had with two hundred fathoms of line. This isolated spot gave no other evidence of its ever having been inhabited, except groves of cocoa-nut trees * * *"

While we have no record that Captain Hudson's party went ashore and made careful search of the island, it is logical to assume that the rough sea prevented their landing or they would surely have discovered the lagoon which was described in 1889 as "three quarters by one half a mile and eight fathoms deep" (7). The writer sounded and got no bottom with a 10-fathom fish line. While no accurate measurements were made, the impression was gained that the lagoon is larger than stated in the old survey quoted. There is some evidence that shifting sands have closed an opening to the west and the possibility of a previous opening of the lagoon to the sea is clearly stated in the manuscript to be quoted presently.

Wilkes (1) reported that the island was well wooded and mentioned coconuts. Part of the present grove of coconut trees is undoubtedly over 100 years old, and, since the crop of copra had been worked for "a long time" before Jennings occupied the island, it was probably occupied from time to time for many years prior to Captain Hudson's visit. Bowditch Island (discovered by Hudson), now called Fakaofo (Tokelau Islands), is only about 90 miles away and this would permit visits by the adventurous natives. Little time was available to make

careful search for archeological remains and artifacts to date the possible previous occupations. However, two small stone implements were found and from this find the conclusion is drawn that this island has probably had several periods of occupancy. This island was settled by Mr. Eli Hutchinson Jennings of Long Island, New York, on October 13, 1856. (8) Exactly how long it was inhabited prior to the arrival of Mr. Jennings is a matter of much conjecture.

The present owner of the island, A. E. Jennings, a grandson of E. H. Jennings, kindly loaned the writer a manuscript which records amongst many other interesting items a murder by drowning of one of the natives prior to the arrival of Mr. Jennings. Unfortunately this is not a complete manuscript and the motive for the murder is not stated. The following quotations from this manuscript are of interest:

"The Tokelau's still stayed on after Kaifale was killed and made Faiva their chief, as he was the oldest and came from a chief family in the Tokelau's. Sula did not return to Olosega, but went to Nukunono with his wife Tuisu and their daughter Elena. They stayed a while in Nukunono and then went to Wallis * * * Sula went to Samoa where he took a Samoan woman, called Mele, as a wife * * * Sula with his wife then again came to Olosega, being brought there by "Bulu." Bulu was the Samoan name for Mr. Bullock, reputed to be a Frenchman, who had worked the copra crop of Olosega for some time prior to the arrival of Mr. Jennings."

This record is far too long for inclusion in a historical note, but it is probably the most valuable document in existence concerning the flora of the island and the customs of the people. From it we learn that the Tokelaus and Sulu continued making "cocoa-nut oil¹ for Pulu² as before and waited for him in his vessel; there was a Britisher on board called Papalii who was mate. They came from Samoa. They took the barrels of cocoa-nut oil * * * and Sulu left Olosega by this ship * * * for Samoa. Bulu left only the Tokelau's on the island with orders to keep on making oil, and also that when any white man came to Olosega they were not to receive him telling him the oil belonged to Pulu * * * They stayed on a very long time,³ but he did not arrive. They made a lot of oil and filled all the barrels * * * so stopped making oil as there was nothing to put it in * * * At last a ship arrived from Samoa belonging to a white man called 'Ilai', an American (Mr. Eli H. Jennings) who came with his wife, a Samoan woman called Maria of Lefaga, with their daughter Phoebe, a Samoan girl called Asalina, two Samoan men called Sione and Papu, and another white man called Misi Ama, an American. (Note by translator: We do not know today who it was.)

"When Mr. Jennings arrived no one was living on the west side. The Tokelau's were living together on the part of the island called Temafa. * * * The houses used by them when Sula and Sale and other white men were on the island were still there but no one was living in them. After all the white men left Olosega and it was a long while * * * One day Tepule, a grown up Tokelau, said to the boys, 'Tevaka and Kawa, let us go to visit the other side and see if there is any bonito.' They launched a canoe on the lagoon to go to the west side where they kept their bonito canoes. (Note by translator: This proves there was once a channel from the lagoon to the west side.) Upon their arrival on the west side they discovered the strange boat of Mr. Jennings, who was informed that the island belonged to Bulu (Bullock).

"There was a fono (council) of the people to decide whether Jennings was to be driven away, but he persuaded them to allow him to remain, probably because of the presence of his Samoan wife. It was decided that they might remain and a

¹ Making this coconut oil was in all probability the present practice of making copra.

² It is common to have "P" substituted for "B" in the spelling of the Samoans.

³ Some interesting family life and vital statistics are here recorded.

place for the erection of a house was set aside and eventually the papalagi house (white-man's house) was erected and Jennings introduced religion to the natives, all of whom were pagans. He taught them to count the days of the week and held services at which he read the Bible. Following the services Jennings began searching for suitable sites to plant his bananas, breadfruit, etc.

"Eighteen days after Jennings arrived Pulu (Bullock) returned for his oil. Jennings roundly scolded the natives for going to Bullock's ship without his permission and finally sent for Bullock who shook hands and said, 'Halloh, you here?' Ilai said, 'Yes.' They had a conversation together, Ilai telling Pulu that a white man called Jione and his wife, Malaca, had told him (Jennings) in Samoa that they had both been in Olosega before and also told him to come to Olosega' * * * 'Make anything out of it for yourself. I am getting tired of traveling in the sea. I have made money enough and I have no children. You have children.' Pulu (Bullock) then left and never came back to Olosega again * * * leaving Olosega to Ilai (Jennings) to settle.' * * * The first Eli Hutchinson Jennings from South Hampton, N. Y., landed here October 13, 1856, and died on Olosega in 1878."

For more than 80 years the island has been owned by the Jennings family and now solely by A. E. Jennings (9). During this period it had no government save that of the Matai. In this system, a Matai or chief is elected for each family by popular vote and may be deposed by family referendum. The Matais of the village discuss community matters in a fono (council) and matters which cannot be decided by this method go to the district fono for further discussion and disposition.

On several occasions the Jennings family requested the United States Government to give them protection and to place the island under the American flag. Finally, on representation of the American consul at Apia, Western Samoa, and the Governor of American Samoa, Congress approved an act on March 4, 1925, which brought the island under American sovereignty.

In May 1925, Capt. Edwin T. Pollock, Governor of American Samoa, sent the U. S. S. *Ontario* with Lt. Comdr. C. D. Edgar, United States Navy, to represent him in the flag ceremony. At 3 p. m., May 13, 1925, Lieutenant Commander Edgar read his orders and the joint resolution of Congress and duly proclaimed the sovereignty of the United States. The American flag was hoisted, and a national salute of 21 guns was fired by the U. S. S. *Ontario* (10). Now "Old Glory" floats over Swains Island and an annual visit is made by officials of American Samoa to be present at the flag-day exercises.

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- (4) U. S. Hydrographic Office Chart No. 1500.
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- (7) British Survey Chart no. 1880, dated 1889.
- (8) Story of Olosega. "Translated from U. S. by old natives of Tokelau Islands who were on the island when Mr. A. E. Jennings arrived there on October 13, 1856. Translated by I. H. Carruthers, continued from where translation by Skeen ended."
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* Portion of the manuscript destroyed.

FOOD POISONING

U. S. S. *Flusser*: Outbreak occurred on December 6, 1936, while en route from New York to Villefranche, France, on shakedown cruise.

Onset.—Sudden.

Symptoms.—Nausea and vomiting lasting about 3 hours; severe griping abdominal cramps; diarrhea; chills; pale, moist skin; headache; general muscular soreness and weakness; prostration.

Suspected food.—Ham. Inspected for quality before and after being received on board and were apparently in good condition. They were stored in the original boxes in the chill room which is maintained at about 45° F. and kept in a sanitary condition at all times.

Of the 55 men known to have been affected some were only slightly ill and did not go to bed. A number were sick enough to require remaining in bed several hours. Some six or eight were quite ill and one man was dangerously ill for a few hours.

After a study of all details surrounding the outbreak had been completed the medical officer was of the opinion the illness was due to some bacterial toxin and that the probable source was from the hands of the cook who had complained of headache while engaged in the preparation of the ham. It was believed that after the ham had been prepared and returned to the oven to be kept warm until served was favorable to the rapid increase in the organism responsible for this toxin.

No food was available for examination.

U. S. S. *Pope*: Canned corned beef caused 46 cases of food poisoning during the month of December. No epidemiological report of the outbreak has been received in the Bureau.

U. S. S. *Memphis*: Outbreak occurred on December 1, 1936, while the ship was undergoing repairs at the Navy Yard, Mare Island, Calif. Of 45 members of the general mess affected, 32 were transferred immediately to the United States Naval Hospital, Mare Island, Calif. for treatment. Recovery was prompt.

Onset.—Sudden. Forty-two of the cases occurred from 3 to 6 hours after ingestion of the suspected ham.

Symptoms.—Nausea, unusually severe vomiting, abdominal cramps, watery diarrhea, and prostration.

Suspected food.—Boiled ham served at dinner on December 1. The hams appeared to be in good condition and were refrigerated until 11 a. m. on November 30. They went into the cookers at 1 p. m. and were cooked until 6:30 p. m. when they were removed and kept in the galley in a warming oven on which the steam was cut off, until the next day. They were sliced at 9:30 a. m. and served at noon, 18 hours after cooking. Specimens of the ham were secured with sterile precautions wrapped in sterile towels and sent immediately

to the laboratory of the Naval Hospital, Mare Island, Calif. None was fed to experimental animals. The following reports were received from the laboratory:

Specimen of suspected whole ham.—Culture for Gram negative bacilli—none found.

Specimen of sliced ham.—Gram negative bacilli isolated that cultured characteristic of *B. coli*. There was an acid and gas production on glucose, lactose, maltose, saccharose, and mannite from a motile Gram negative bacilli.

A pronounced "shift to the left" was noted in all of the white blood counts.

B. enteritidis (Gaertner) was probably the infecting organism.

U. S. S. *California*: Mild outbreak occurred during the early evening and night of November 8, 1936. Sixty-eight members of the general mess were affected.

Onset.—Sudden. The first case appeared 2½ hours after eating. The vast majority appeared in from 5½ to 8 hours.

Symptoms.—Nausea, colicky pain in the epigastrium, vomiting, loose stools, slight frontal headache.

Suspected food.—Macaroni salad (chopped boiled ham, boiled macaroni, celery, onions, and sweet pickle relish), served at the evening meal on November 8. The following were served as part of this meal: Cold meats (luncheon meat and bologna); head cheese, sliced cream cheese; black eyed peas with pork rind; iced chocolate cake; bread and butter; jam and cocoa. Macaroni salad was the only article in the above meal partaken of by all 68 men affected. The salad was examined aboard the U. S. S. *Relief* and showed contamination by the *Shigella paradysenteriae* (Sonne). The ham was general issue obtained from the U. S. S. *Arctic* on October 20 and kept in the chill room until the morning of November 6. They were cooked in steam kettles for 4½ hours and placed in butcher shop overnight. Sliced ham was served at noon meal on November 7. The hams for salad were placed in tins and allowed to remain in the galley on a cold range until the following morning (Nov. 8) when the salad was mixed. Ham was the suspected article in view of the fact that it had stood overnight in a warm place. No ham was available for examination.

U. S. S. *California*: A second mild outbreak occurred during the afternoon of November 21. Fifteen members of the general mess were affected but none were admitted to the sick list.

Onset.—Sudden. First case appeared 2 hours after eating. Practically all reported in from 4 to 5 hours after eating.

Symptoms.—Nausea, colicky pain, vomiting.

Suspected food.—The meal concerned was composed of the following: Boiled ham, cabbage, potatoes, carrots, turnips; bread, butter, and coffee; sweet pickles; fruit salad (peaches, pineapple, pears). Ham was the only article in the above meal eaten by all affected and was the only item of food which also appeared in the meal of November 8,

except for bread and butter. No sample could be obtained for bacteriological examination.

The hams were of the same general issue obtained from the U. S. S. *Arctic* on October 20, 1936, that had been used on November 8. They were taken from the chill room in the morning of November 20 and boiled in steam kettles for 4½ hours, placed in pans and allowed to remain overnight in the butcher shop. They were sliced early the next morning, placed in iron pans in cold ovens in the galley and served at 1200 Saturday November 21.

No bacteriological examination of feces or vomitus was made. An examination was made of the one ham of this issue which remained in the chill room, but no macroscopic evidence of contamination could be noted.

It would seem from a study of the above that the ham was the offending article instead of secondary infection by some handlers in the galley as first suspected, and that an occasional ham was probably improperly cured and infected and that organisms were not entirely killed during the boiling process. A contaminated ham sliced finely and mixed thoroughly in a salad would be partaken of by many more individuals than would one which was served in slices.

HEALTH OF THE NAVY

The following tables are summaries of morbidity rates per 1,000 for the fourth quarter of 1936 in comparison with rates for the corresponding quarter of the preceding 5 years:

Entire Navy

Year	All diseases	Injuries	Poisonings	All causes	Communicable diseases		Venereal diseases
					A	B	
1931.....	506	57	1.67	565	(1)	(1)	140
1932.....	502	54	.15	556	(1)	(1)	129
1933.....	402	68	.57	471	9	109	89
1934.....	554	62	5.43	622	26	171	114
1935.....	409	61	.45	470	8	126	73
1936.....	474	74	1.62	550	15	118	96

Forces ashore

1931.....	564	67	3.57	634	(1)	(1)	96
1932.....	629	63	.31	692	(1)	(1)	95
1933.....	523	85	.46	608	9	158	66
1934.....	610	77	.41	687	35	192	68
1935.....	427	63	.74	491	9	151	39
1936.....	459	97	1.14	557	13	121	46

Forces afloat

1931.....	472	51	0.62	524	(1)	(1)	164
1932.....	432	48	.06	481	(1)	(1)	147
1933.....	344	60	.62	405	9	86	100
1934.....	525	53	8.12	586	21	160	139
1935.....	398	59	.28	457	8	111	93
1936.....	483	61	1.90	546	15	115	125

¹ Not available.

139183—37—6

Common infectious diseases of the respiratory type.—A total of 3,063 admissions was reported from the entire Navy during the fourth quarter of the year 1936, indicating a 62 percent increase from the number of cases notified for the corresponding quarter of 1935. Catarrhal fever was responsible for 2,308 of the total admissions.

Ships and shore stations reporting the largest number of cases were as follows:

	October	November	December	Total
Naval training station, San Diego, Calif.....	39	31	194	264
Naval training station, Norfolk, Va.....	67	58	64	189
U. S. S. <i>Colorado</i>	7	6	95	108
Naval Academy, Annapolis, Md. (midshipmen).....	56	19	25	100
Regimental hospital, Fourth Marines, Shanghai, China.....	0	14	83	97
U. S. S. <i>Saratoga</i> (fleet air detachment).....	29	30	35	94
Naval training station, Newport, R. I.....	19	29	30	78
U. S. S. <i>Nevada</i>	4	2	69	75
Naval air station, Pensacola, Fla.....	19	26	28	73
Marine detachment, American Embassy, Peiping, China.....	6	1	58	65
Marine Corps Base, San Diego, Calif.....	12	19	32	63
Marine Barracks, Quantico, Va.....	17	23	22	62
U. S. S. <i>Tennessee</i>	16	15	23	54
U. S. S. <i>Saratoga</i>	15	17	20	52
Naval air station, San Diego, Calif.....	11	11	19	41
U. S. S. <i>Maryland</i>	5	2	30	37
U. S. S. <i>Lexington</i>	12	14	10	36
Fleet air base, Pearl Harbor, Hawaii.....	10	10	12	32

The senior medical officer of the naval training station, San Diego, commented as follows in his sanitary report for the month of December:

In December there was an increase in both sick days and admission rate in comparison with the months immediately preceding. This increase, however, is considered seasonal and is due largely to acute respiratory infections. A portion of this increase has also been due to the policy of admitting many cases with but mild symptoms, hitherto treated as outpatients, in an effort to diminish the spread of this type of infection. It is believed that this policy will have some effect in decreasing this type of case in the remaining winter months.

Fourteen cases of chickenpox were reported for the quarter as follows: In November one case from the Marine Barracks, Quantico, Va., and one from the U. S. S. *Salt Lake City*; and in December seven from the U. S. S. *Arizona*, two from the Regimental Hospital, Fourth Marines, Shanghai, China, and one each from the Naval training station, Norfolk, Va., U. S. S. *Idaho*, and the U. S. S. *West Virginia*.

The U. S. S. *Black Hawk* reported a fatal case of typhoid fever. A coxswain, 26 years of age, with 7 years and 8 months service, was admitted to the sick list on December 27, 1936, and died on January 1, 1937. The contributory cause of death was recorded as peritonitis, general, acute. One course of typhoid prophylaxis had been completed May 8, 1933.

There were five cases of cerebrospinal fever reported during October, November, and December, 1936, as follows:

Rate	Age	Place of original admission	Date of admission	Length of service (years)	Disposition
W.T. 1c....	28	U. S. S. <i>Wyoming</i>	Oct. 14, 1936	9 ³ / ₁₂	Still on list.
Sea. 2c....	20	U. S. S. <i>Colorado</i>	Nov. 10, 1936	4 ¹ / ₁₂	No disposition record received.
H.A. 1c....	25	Staff, Naval Hospital, Puget Sound, Wash.	Nov. 25, 1936	4 ⁵ / ₁₂	Do.
Pvt.....	28	Naval Ammunition Depot, Portsmouth, Va.	Dec. 17, 1936	6 ⁹ / ₁₂	Duty, Mar. 9, 1937.
Sea. 1c....	26	U. S. S. <i>Erie</i>	Dec. 18, 1936	4 ¹ / ₁₂	Duty, Mar. 5, 1937.

The senior medical officer of the U. S. Naval Academy, Annapolis, Md., reported in the October monthly sanitary report that "the general health of the regiment has been good, except for a slight outbreak of gastroenteritis about the 7th and 8th of the month. Approximately 20 cases were admitted to the sick list."

Summary of morbidity in the United States Navy, for the quarter ended Dec. 31, 1936

Average strength.....	Forces afloat 79,950		Forces ashore 45,726		Entire navy 125,676	
	Admissions	Rate per 1,000	Admissions	Rate per 1,000	Admissions	Rate per 1,000
All causes.....	10,908	545.74	6,371	577.32	17,279	549.95
Disease only.....	9,645	482.55	5,249	459.17	14,894	474.04
Injuries.....	1,225	61.29	1,109	97.01	2,334	74.29
Poisonings.....	38	1.90	13	1.14	51	1.62
Communicable diseases transmissible by oral and nasal discharges (class VIII):						
(A).....	304	15.21	153	13.38	457	14.55
(B).....	2,305	115.32	1,388	121.42	3,693	117.54
Venereal diseases.....	2,499	125.03	524	45.84	3,023	96.22

Deaths reported, entire Navy, during the quarter ended Dec. 31, 1936

Cause—Diseases		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Average strength.....		9,692	2,312	95,648	1,322	16,314	388	125,676
Appendicitis, chronic.....	Obstruction, intestinal, from spastic or paralytic causes.			1				1
Angina pectoris.....	Arteriosclerosis, general.			1				1
Do.....	Dilatation, cardiac, acute.		1					1
Agranulocytosis.....	do.....		1					1
Do.....	Purpura, hemorrhagica.			1				1
Angina, Ludwig's.....	Impacted tooth.					1		1
Calculus, renal.....	Atelectasis.					1		1
Carcinoma, stomach.....	None.			1				1
Catarrhal fever, acute.....	Pneumonia, broncho.			1				1
Do.....	Pneumonia, lobar.			1				1
Cerebrospinal fever.....	None.			1				1
Endocarditis, acute.....	None.			1				1
Endocarditis, acute ulcerative (malignant).....	None.			1				1
Hemorrhage, cerebral.....	Arterial hypertension.	1		1				2
Influenza.....	None.					1		1
Nephritis, chronic.....	None.			1				1
Do.....	Arterial hypertension.	1		1				2
Pneumonia, broncho.....	None.			1				1

Deaths reported, entire Navy, during the quarter ended Dec. 31, 1936—Contd.

Cause—Diseases		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Pneumonia, lobar.....	None.....	1		5				6
Do.....	Pleurisy, suppurative, and abscess, brain.	1						1
Septicemia.....	None.....			1				1
Teratoma, metastatic mediastinum.....	None.....			1				1
Thrombosis, coronary.....	None.....	4		3		1		8
Thrombosis, mesenteric.....	None.....	1						1
Tonsillitis, acute.....	Nephritis, acute.....					1		1
Do.....	Pneumonia, broncho.....			1				1
Tuberculosis, pulmonary, chronic.....	None.....			1		1		2
Do.....	Tuberculosis, intestines.....			1				1
Tuberculosis, general military.....	None.....			1				1
Tumor, malignant, mixed, pylorus (adenocarcinoma).....	None.....	1						1
Tumor, malignant, mixed, lung (lymphoblastoma).....	None.....					1		1
Valvular heart disease, aortic stenosis.....	Myocarditis, chronic.....			1				1
Total for disease.....		10	2	28		7		47
INJURIES AND POISONINGS								
Crush, chest.....	None.....	1						1
Drowning.....	None.....			9				9
Fracture, compound:								
Frontal.....	Intracranial injury.....			2				2
Skull.....	None.....			1		1		2
Do.....	Burn, head, chest, and upper extremities.			1				1
Fracture, simple, pelvis.....	Rupture, traumatic, urinary bladder.			1				1
Fracture, simple, ribs and sternum.....	Hemorrhage, traumatic, into pericardial and plural cavities.					1		1
Fracture, simple, skull.....	Intracranial injury.....			1				1
Injuries, multiple, extreme.....	None.....	7		4	1	2		14
Do.....	Rupture, traumatic, diaphragm.			1				1
Intracranial injury.....	None.....	1						1
Do.....	Intracranial hemorrhage.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Intraspinal injury.....	None.....			1				1
Rupture, traumatic, liver.....	None.....	1						1
Strangulation, neck.....	None.....					1		1
Wound, gunshot:								
Chest.....	None.....			1				1
Head.....	None.....			2				2
Do.....	Psychosis, unclassified.....			1				1
Heart.....	None.....			1				1
Wound, lacerated, jugular veins.....	None.....			1				1
Poisoning, acute, cyanide.....	None.....			1				1
Poisoning, acute, phosphorous (rat poisoning).....	None.....			1				1
Total for injuries and poisonings.....		10		31	1	5		47
Grand total.....		20	2	59	1	12		94
Annual death rate per 1,000:								
All causes.....		8.25	3.46	2.48	3.03	2.94		3.00
Diseases only.....		4.13	3.46	1.17		1.72		1.50
Drowning.....				.38				.29
Poisonings.....				.08				.06
Other injuries.....		4.13		.84	3.03	1.23		1.15

ADMISSIONS FOR INJURIES AND POISONINGS, FOURTH QUARTER, 1936

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the fourth quarter, 1936, is based upon all form F cards covering admission in those months which have reached the Bureau:

	Admissions, October, November, and Decem- ber 1936	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1935
INJURIES			
Connected with work or drill.....	1,053	3,351	2,592
Occurring within command but not associated with work.....	737	2,346	1,709
Incurred on leave or liberty or while absent without leave.....	544	1,731	1,651
All injuries.....	2,334	7,429	5,952
POISONINGS			
Industrial poisoning.....	2	6	17
Occurring within command but not connected with work.....	38	121	43
Associated with leave, liberty, or absence without leave.....	11	35	19
Poisonings, all forms.....	51	162	79
Total injuries and poisonings.....	2,385	7,591	6,030

Percentage relationships

	Occurring within command				Occurring outside command—leave, liberty, or absent without leave	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	October, November, and December 1936	Year 1935	October, November, and December 1936	Year 1935	October, November, and December 1936	Year 1935
Percent of all injuries.....	45.1	43.6	31.6	28.7	23.3	27.7
Percent of all poisonings.....	3.9	21.1	74.5	54.4	21.6	24.4
Percent of total admissions, injury and poisoning titles.....	44.2	43.3	32.5	29.0	23.3	27.7

NOTE.—Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism", as the case may be. Such cases are not included in the above figures. There were no cases during the third quarter of 1936 worthy of notice from the standpoint of accident prevention.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following statistics were taken from sanitary reports submitted by naval training stations:

October, November, and December 1936	U. S. naval training station			
	Norfolk, Va.	Newport, R. I.	Great Lakes, Ill.	San Diego, Calif.
Recruits received during the period.....	1,265	571	601	1,095
Recruits appearing before Board of Medical Survey.....	5	0	7	0
Recruits recommended for discharge from the service.....	5	0	7	0
Recruits discharged by reason of medical survey.....	5	0	2	0
Recruits held over pending further observation.....	0	0	0	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment....	18	22	92	17

The following table was prepared from reports of medical surveys in which disabilities or disease causing the surveys were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Abscess, periapical.....	1	Furunculosis.....	1
Adhesions, peritoneal.....	1	Genu valgum.....	1
Amputation stump, 2d finger, right hand, distal phalanx.....	1	Hematuria.....	1
Angina, Vincent's infection.....	1	Hernia, inguinal.....	1
Arterial hypertension.....	1	Hernia, ventral.....	1
Arthritis, chronic, left knee.....	2	Malformation, congenital, urethra.....	1
Bronchitis, chronic.....	2	Malocclusion, teeth.....	1
Callosity.....	1	Metatarsalgia.....	1
Caries, teeth.....	1	Nephritis, chronic.....	1
Constipation.....	1	Neurosis, traumatic.....	1
Constitutional psychopathic inferiority, without psychosis.....	4	Otitis, media, acute.....	1
Constitutional psychopathic state, emotional instability.....	2	Otitis, media, chronic.....	3
Deafness, unilateral, right ear.....	1	Psychoneurosis, hysteria.....	1
Defective physical development.....	1	Pyelitis, left.....	1
Deviation, nasal septum.....	2	Rhinitis, atrophic.....	2
Dislocation, articular cartilage.....	1	Sinusitis, maxillary.....	1
Enteritis, chronic.....	1	Somnambulism.....	1
Enuresis.....	4	Sprain, left knee.....	1
Epilepsy.....	1	Synovitis, right ankle, chronic.....	1
Epilepsy, Jacksonian.....	1	Tuberculosis, pulmonary, chronic, active.....	1
Flat foot.....	13	Valvular heart disease, aortic insufficiency.....	1
		Valvular heart disease, mitral insufficiency.....	1
		Valvular heart disease, mitral stenosis.....	3



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THE MISSION OF THE MEDICAL CORPS OF THE NAVY

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**TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**

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NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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OCT 22 1937

TABLE OF CONTENTS

	Page
PREFACE	VII
NOTICE TO SERVICE CONTRIBUTORS	VIII
SPECIAL ARTICLES:	
— QUANTITATIVE STUDY OF MENTAL AND NEURO-MUSCULAR REACTIONS AS INFLUENCED BY INCREASED AIR PRESSURE. By C. W. Shilling, Lieutenant, Medical Corps, United States Navy, and W. W. Willgrube, Chief Pharmacist's Mate, United States Navy.....	373
THE RELATION OF CARBON DIOXIDE TO ARTIFICIAL RESPIRATION. By F. S. Johnson, Commander, Medical Corps, United States Navy.....	380
PRESENT-DAY CONCEPTS OF ENDOCRINOLOGY. By Paul F. Dickens, Lieutenant Commander, Medical Corps, United States Navy, and Omar J. Brown, Lieutenant, Medical Corps, United States Navy.....	387
THE TREATMENT OF MALARIA WITH ATABRINE FOLLOWED BY PLAS- MOCHIN. By C. R. Ball, Lieutenant, Medical Corps, United States Navy..	418
A CONSIDERATION OF THE MECHANISM AND TREATMENT OF SURGICAL SHOCK. By T. R. Austin, Lieutenant (Junior Grade), Medical Corps, United States Navy.....	426
TO WHAT EXTENT IS REALITY ADJUSTMENT CONCERNED IN THE SELECTION OF THE FLYING TRAINEE? By John W. Vann, Commander, Medical Corps, United States Navy.....	434
COPPER SULPHATE TREATMENT OF TRICHOPHYTOSIS. By James B. Moloney, Lieutenant Commander, Medical Corps, United States Navy.....	440
ORAL DIAGNOSIS AS A PROCEDURE IN INDEXING GENERAL DISEASES MANIFESTED IN THE MOUTH. By Curtiss W. Schantz, Lieutenant, Dental Corps, United States Navy.....	441
HEPATITIS, ACUTE. By Julian Love, Lieutenant, Medical Corps, United States Navy..	446
A STUDY OF SYPHILIS IN THE NAVY. By D. T. Prehn, Lieutenant, Medical Corps, United States Navy..	450
AN EVALUATION OF RECENT TRENDS IN THE MEDICAL TREATMENT OF PEPTIC ULCER. By Edgar Rican, Lieutenant, Medical Corps, United States Navy.....	460
CLINICAL NOTES:	
THE "PHYSICIAN'S CHANCRE." By Bartlett C. Shackford, Lieutenant Commander, Medical Corps, United States Naval Reserve, Long Beach, California..	469
EXTRA-GENITAL CHANCRE—REPORT OF CASE WITH UNUSUAL LOCA- TION. By C. W. Stelle, Lieutenant, Medical Corps, United States Navy..	470

CLINICAL NOTES—Continued.

GONORRHEAL OPHTHALMIA: REPORT OF A CASE TREATED BY HYPERTHERMIA.	Page
By Jack Terry, Commander, Medical Corps, United States Navy.	472
CANCER OF THE PENIS.	
By Willard S. Sargent, Lieutenant Commander, Medical Corps, United States Navy.....	473
TRICHINOSIS, WITH A REPORT OF TWO CASES.	
By Maurice Joses, Lieutenant Commander, Medical Corps, United States Navy, and John J. Wells, Lieutenant, Medical Corps, United States Navy.....	475
DIVERTICULUM OF THE STOMACH.	
By Paul Richmond, Jr., Commander, Medical Corps, United States Navy.....	480
ACUTE INTESTINAL OBSTRUCTION DUE TO ROUNDWORMS.	
By Willard S. Sargent, Lieutenant Commander, Medical Corps, United States Navy.....	482
REPORT OF THREE CASES OF AGRANULOCYTOSIS.	
By C. L. Blew, Lieutenant, Medical Corps, United States Navy.	484
SUGGESTED DEVICES:	
A POISON ANTIDOTE BOX.	
By James D. Blackwood, Jr., Lieutenant Commander, Medical Corps, United States Navy.....	489
NAVAL RESERVE.....	491
NOTES AND COMMENTS:	
The eleventh Surgeon General, United States Navy—Certificate of merit awarded Navy exhibit—Combination of Schafer and Silvester methods of artificial respiration—Dientamoeba Fragilis—Liver therapy in sprue—Effect of fatigue on adjustment of the eye to near and far vision—Tuberculosis in wild voles—American College of Surgeons—American College of Physicians—Military Surgeons' Convention—American Board of Otolaryngology—Human machine in deep-sea diving—Percentage solutions—Influenza—Digest of treatment.....	493
BOOK NOTICES:	
Who Gave the World Syphilis, Holcomb—Modern Treatment and Formulary, Mullen—Diseases of the Coronary Arteries and Cardiac Pain, Levy—Heart Disease, White—Endocrinology, Werner—Principles of Pharmacy, Arny—Physical Diagnosis, Major—The Art of Compounding, Scoville—Urological Roentgenology, Wesson and Ruggles—Intellectual Functions of the Frontal Lobes, Brickner—Eugenical Sterilization—Laboratory Outline in Filterable Viruses, Hyde and Gardner—Dietetics for the Clinician, Bridges—Applied Dietetics, Blum—Oral Diagnosis and Treatment Planning, Miller—Textbook of Operative Dentistry, McGehee—Allergic Diseases, Balyeat and Bowen—Physical Therapeutic Methods in Otolaryngology, Hollender—Introduction to Comparative Biochemistry, Baldwin—Synopsis of Ano-Rectal Diseases, Hirschman—Bright's Disease and Arterial Hypertension, Stone—Ocular Therapeutics, Gifford—Manual of Biological Assaying, Munch—Essentials of Electrocardiography, Ashman—Inhalation Anesthesia, Guedel—Ten Million Americans Have It, Becker—Taylor's Practice of Medicine, Poulton—Clinical Laboratory Diagnosis, Levi-son—Nicaragua, United States Medical Corps.....	507

PREVENTIVE MEDICINE:**TOXIC EFFECTS OF ARSENICAL COMPOUNDS AS ADMINISTERED IN THE UNITED STATES NAVY IN 1936 WITH SPECIAL REFERENCE TO ARSENICAL DERMATITIS.**

By C. S. Stephenson, Commander, Medical Corps, and E. H. Wingo, Chief Pharmacist's Mate, United States Navy.....	Page 517
WATER SUPPLY—NAVAL STATION, GUAM.....	535
FOOD POISONING ON BOARD THE U. S. S. "MARYLAND".....	541
VENEREAL DISEASES—U. S. S. "PENNSYLVANIA".....	542
COMMON INFECTIOUS DISEASES OF THE RESPIRATORY TYPE, FIRST QUARTER, 1937.....	545
STATISTICS:	
HEALTH OF THE NAVY.....	550
DEATHS REPORTED, ENTIRE NAVY, DURING THE QUARTER ENDED MARCH 31, 1937.....	554
ADMISSIONS FOR INJURIES AND POISONINGS, FIRST QUARTER, 1937...	555
STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS.....	556
INDEX.....	557

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, and reports from various sources, notes, and comments on topics of medical interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

P. S. ROSSITER,
Surgeon General, United States Navy.

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Contributions to the **BULLETIN** should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received at least 3 months prior to the date of the issue for which they are intended.

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SPECIAL ARTICLES

QUANTITATIVE STUDY OF MENTAL AND NEURO-MUSCULAR REACTIONS AS INFLUENCED BY INCREASED AIR PRESSURE¹

By C. W. SHILLING, Lieutenant, Medical Corps, United States Navy, and W. W. WILLGRUBE, Chief Pharmacist's Mate, United States Navy²

Men exposed to increased air pressures of 5 atmospheres (gage) or above have a definite feeling of stimulation and well-being which they liken to a feeling of "drunkenness." During such an air-pressure exposure, they have an exaggerated confidence in their ability to accomplish a given task, but to the observer their actual accomplishment falls far short of that demonstrated at atmospheric pressure. This failure of accomplishment was noted, associated with emotional disturbances, in the 1931 deep-diving trials of the British Navy, and was reported by both Phillips (1), and Hill and Phillips (2). Behnke, Thomson, and Motley (3) wrote a theoretical paper entitled "The Psychologic Effects from Breathing Air at 4 Atmospheres Pressure" in which they described the abnormal reactions of nine individuals engaged in physiological research work under pressure of 4 atmospheres (absolute). Damant (4) also made reference to the change in behavior which men undergo when exposed to increased air pressure. Although much has been written concerning the impaired neuromuscular coordination, the slowed mental activity, and the alterations of behavior brought on by exposure to increased air pressure, no one has reported any quantitative experiments designed to actually demonstrate the type and degree of these changes. The present paper is a report of such a quantitative study.

Problems.—Sets of simple problems, each sheet of which consisted of four problems—namely, one each in addition, multiplication, subtraction, and division—were compiled. One of the set was used for each pressure studied, the first sheet of the set being used at atmos-

¹ Received for publication May 4, 1936. From the laboratory of the experimental diving unit, Department of Construction and Repair, Navy Yard, Washington, D. C.

² We wish to express our appreciation for the suggestions and advice given by Commander E. L. Gayhart, Construction Corps, U. S. Navy, and Commander F. S. Johnson, Medical Corps, U. S. Navy, members of the advisory committee; J. A. Hawkins, D. Sc., and Lt. (Jr. Gr.) O. D. Yarbrough, Medical Corps, U. S. Navy, members of the staff; Lt. J. A. Hollowell, U. S. Navy, officer in charge, and Lt. R. A. Hansen, U. S. Navy, formerly officer in charge of the experimental diving unit.

pheric pressure immediately before the air-pressure dive, and the second sheet being used at the pressure selected. The difference of time in seconds (stop watch) required to complete each sheet of problems was recorded. The difference in the number of errors at atmospheric pressure and at each increased air pressure was also recorded.

Number cross-out.—In using the number cross-out sheets, the subjects were asked to cross out as many of a given numeral as possible in 1 minute. Two test sheets were run immediately before each pressure, and one at the pressure being studied.

Light-to-touch reaction time.—The subject sat in the recompression chamber described by Hawkins and Shilling (5), and watched an electric-light bulb situated in an eye port. When the light was turned on, the subject pressed a telegraph key. A Fauth chronograph with three solenoid operated pens was used to record the operations; one pen was operated by a chronometer and made a mark every half second on the cross-section paper covering the drum, the second pen made a mark each time the light in the eye port was turned on, and the third pen made a mark when the subject within the chamber pressed the telegraph key. The light was turned on and off at irregular intervals during a 2-minute run, and the lag in response as measured by the distance between the two pen marks was recorded as the reaction time. All of the 40 to 50 responses for the 2-minute run were measured and the average taken as the figure for the run. Control runs were made at atmospheric pressure before each pressure run.

SUBJECTS

The 46 subjects for these tests were the officers and men attached to both the experimental diving unit and the Deep Sea Diving School, and the last two classes of students at the Deep Sea Diving School.

Experimental data.—The difference in the time required (measured in seconds) to complete a sheet of problems at atmospheric pressure, and the time required to complete the paired sheet of the set under increased air pressure is reported in table 1. The first column presents the results of an atmospheric check run. In this run, the first sheet of each set was run at atmospheric pressure as usual, but the second sheet of each set instead of being run under increased air pressure was also run at atmospheric pressure. The very small time variation (0.35 second) is proof that there is not sufficient difference in the problem sheets to account for the increases in time required for accomplishment under increased air-pressure conditions. It will be noted that the additional time required at 90 feet is greater than that required at 100 feet (44.5 pounds gage air pressure). This is un-

doubtedly due to the fact that for many subjects this 90-foot air-pressure dive was their first pressure experience, and an additional element of apprehension was added to the real effect of the increased air pressure. The progress from 100 feet to 300 feet is marked by steadily increasing time differences required for completing the problems, and this increase in time difference is the result of the increased air-pressure effect. At 300 feet, the increase in time is 31.42 seconds, which is an increase of 52.8 percent over the atmospheric check run in which the arithmetic mean for the actual time of accomplishment, for all problem sheets, was 59.54 seconds with a standard deviation of 21.55.

TABLE 1.—*Additional time required to work problems under pressure*

Pressure, feet (gage)...	0	90	100	125	150	175	200	225	250	275	300
Arithmetic mean (sec.).....	0.35	11.09	6.89	7.65	9.74	11.95	13.98	17.17	26.07	26.53	31.42
Standard deviation....	3.25	15.35	11.85	9.54	12.05	16.25	14.4	14.65	25.65	31.45	34.85

As additional evidence of the actual slowing effect on the mental processes even of experienced divers, the staffs of the experimental diving unit and the Deep Sea Diving School, were tabulated separately, and the data presented in table 2 were obtained. Here, again, we find that there is an actual slowing due to the effect of increased air pressure; although in this experienced group the slowing is noticeably less.

TABLE 2.—*Additional time required to work problems under pressure, experienced group only*

Pressure, feet (gage)...	0	90	100	125	150	175	200	225	250	275	300
Arithmetic mean (sec.).....	1.64	2.55	3.42	3.91	4.66	8.00	11.75	15.73	16.33	17.09	24.36
Standard deviation....	3.05	5.82	7.85	7.30	7.99	8.75	14.30	14.65	10.45	10.60	21.10

The errors made on both the atmospheric control sheet and the pressure sheet were noted, and the difference recorded as due to the increased air-pressure effect. These data are presented in table 3, and demonstrate that there is an adverse effect on the accuracy of the group in working problems under increased air pressure. The arithmetic means do not seem large, but when it is realized that there are only 19 possible errors, it will be seen that an average increase in errors of 3.02 for each individual at 300 feet is noteworthy. Actually, several of the subjects went to pieces so completely as to make

10, 11, or 12 errors under pressure, and one or two failed completely to be able to finish so simple a task as the problems.

TABLE 3.—*Additional errors in working problems under pressure*

Pressure, feet (gage)...	0	90	100	125	150	175	200	225	250	275	300
Arithmetic mean.....	0.18	0.86	0.49	0.42	0.72	0.84	1.22	0.88	2.18	2.66	3.02
Standard deviation....	.71	2.29	6.20	1.40	1.17	1.25	2.06	1.33	1.88	3.08	2.92

Number cross-out.—The results obtained from the number cross-out sheets are presented in tables 4 and 5. Table 4 shows the difference in the number of a given numeral crossed out; each pressure compared with its corresponding atmospheric pressure run. The arithmetic means, representing a decrease in the number of the given numeral crossed out, are not large; however the loss progresses steadily as the pressure increases. Since the test is based almost entirely upon attention and neuromuscular control and requires no memory or reasoning this loss in ability is significant. Of even greater significance is the increase in errors, shown in table 5, which occurred while doing the number cross-out test. At 300 feet there is an average of 2.62 errors per individual in this simple test.

TABLE 4.—*Decrease in number of numerals crossed out under pressure*

Pressure, feet (gage).....	90	100	125	150	175	200	225	250	275	300
Arithmetic mean.....	-.59	-.09	-2.26	-2.30	-2.49	-2.55	-4.24	-5.85	-6.43	-8.74
Standard deviation.....	3.87	5.65	4.01	3.55	5.04	5.34	4.34	5.44	3.99	5.46

TABLE 5.—*Additional errors in working cross-out test under pressure*

Pressure, feet (gage)	90	100	125	150	175	200	225	250	275	300
Arithmetic mean.....	1.47	0.74	1.62	1.70	1.72	1.83	1.90	2.23	2.30	2.62
Standard deviation.....	1.76	1.77	2.04	2.14	3.49	2.61	2.15	3.92	2.73	3.22

Light-to-touch reaction time.—Table 6 presents the results of this experiment, and here, again, a slight but definite slowing of reaction time under increased air-pressure conditions is shown:

Additional experiments were conducted at various pressures in "marble sorting", "questions of common sense", and "right and wrong words" which showed the same tendency to loss of ability under increased air pressure, but these experiments were not well adapted for repeated use and were therefore dropped.

TABLE 6.—*Light-to-touch reaction time (seconds)*

Subjects	Pressure, feet (gage)							
	0	150	0	200	0	250	0	300
A.....	0.219	0.248	0.201	0.216	0.209	0.247	0.204	0.232
B.....	.220	.237	.210	.221	.216	.222	.....	.....
C.....	.235	.253	.229	.211	.164	.230	.215	.242
D.....	.260	.245	.183	.264	.263	.246	.183	.280
E.....	.202	.218	.218	.243	.224	.240	.246	.261
F.....	.211	.253	.227	.248	.193	.237	.210	.235
G.....	.203	.204	.189	.213	.209	.235	.....	.....
H.....	.174	.206	.206	.218	.214	.222	.....	.....
I.....	.162	.234	.214	.238	.231	.244	.200	.241
J.....	.232	.236	.190	.250	.242	.260	.200	.258
K.....	.252	.265	.256	.299	.240	.316	.216	.303
L.....	.251	.240	.214	.246	.195	.233	.....	.....
M.....	.221	.252	.229	.281	.....	.....	.....	.....
N.....	.166	.224	.208	.258	.232	.293	.....	.....
Average.....	.215	.237	.213	.242	.218	.248	.209	.257

Special case.—As an example of the effect of increased air pressure on one individual, the following case is reported:

Date: October 23, 1935.

Pressure: 275 feet; suit dive.

Condition previous 24 hours: Normal except for loss of sleep due to 2 a. m. to 6 a. m. watch. The physical examination revealed no defects, and the Schneider score was 13.

Mental tests (275-foot preliminary air run): "Problems", an increase of 24 seconds and 11 errors over the paired atmospheric run. "Number cross-out", a decrease of four numerals crossed out and an increase of four errors over the paired atmospheric run.

Required suit dive task: Remove nut from spill pipe attached to iron work bench, hand nut to diving partner, take hose from partner, attach hose to spill pipe, tighten loose fitting with wrench, open spill pipe valve, close spill pipe valve, take hose off, put nut on, and tighten nut with wrench. Subject started task as usual without being told, but dropped the nut after removing it; he picked it up (should have let partner do this), and put it on the pipe instead of putting on the hose. Next, he opened the spill pipe valve as if the hose had been attached, but did not close the valve. Then he took the wrench and tightened the nut as if the job was completed.

The instructor told him to repeat the job, and he responded, "Stand by to come up." As further instructions failed to elicit any response, his partner was asked to take his turn on the same job. His partner removed the nut and tried to hand it to him, but he would not take it, so his partner placed the nut on the work bench. Instead of handing his partner the hose, as he should have done, he tied the hose around the spill pipe.

At this point it seemed wise to terminate the run and reduce the pressure. The instructors kept in communication with him during the decompression, but at 120 feet he suddenly left his tank air-control valve and picked up the nut from the bench and started to put it back on the pipe. They did not succeed in getting him back to his valve until the first stop (110 feet) in the decompression had been reached. In response to phoned questions during the remaining decompression, he repeatedly stated he was all right and that he had completed his job correctly.

Upon reaching the surface and being questioned, he at first stated he had attached the hose and completed the job; but upon further questioning he admitted he could only remember the following incidents: Taking off the nut, turning on the valve, seeing his partner with him by the workbench, and being told to stand by to come up. He has no memory of the other happenings until he saw the nut on the workbench. He not only knew that he should not pick up the nut when he was doing the job but he also knew it should be on the pipe for a finished job; consequently this started a debate in his mind that seemed to last for a long time, and to be a thing apart from him. He further stated, "These two ideas were coming from two directions like, and they seemed to bounce back and forth in my mind until the idea to pick up the nut became so strong I had to do it, and so I made a dive for it and put it on." At this point, although he thought he was still on the bottom, he was actually at 120 feet. He said that during the dive he knew vaguely that something was wrong, but could not tell what, and cannot now explain. However, when his partner, at the 110-foot stop, punched him in order to get him back to his valve and away from the nut, "everything became clear and plain, like something had been rubbed out."

The problem sheets worked by this subject at both atmospheric pressure and at 275 feet (gage) air pressure demonstrated errors in the air-pressure dive that paralleled the failure of task accomplishment in the actual suit dive. Also, both of these failures under increased air pressure are undoubtedly related to the rather low normal mental ability of this subject.

The problem sheets presented for this subject also show a lack of neatness under pressure, which is common to all subjects. The figures made under pressure are often almost unintelligible, whereas at atmospheric pressure the same subject writes very clearly and neatly.

During the progress of the last 3 years' work at the experimental diving unit and the Deep Sea Diving School there have been a number of occasions in which peculiar emotional reactions have been observed, as well as other cases of failure of accomplishment similar to the example cited. However, these cannot be quantitatively evaluated, and therefore are not included in this report. All those experienced in diving know that during exposure to high pressures there is an appreciable dulling of mental ability, characterized by increased difficulty in the assimilation of facts and in the making of quick and accurate decisions. This dulling may be summed up as a slowing of the process of cerebration. Also, there is a lengthening of the reaction time and a loss in neuromuscular control and response. The data presented in this report serve to demonstrate the accuracy of these experiential deductions and to measure them quantitatively.

In addition, personal experience and careful observation of many men taking pressure has led to the formation of two conclusions, namely, that increased experience materially lessens the subjective

effect of pressure, and that there is a definite relation between normal "atmospheric pressure" mental ability and failure of accomplishment under increased air pressure. That is, men with high mental ability do not fail as quickly under pressure as do those with low mental ability. Further study of this relationship must be conducted; however, even now there is an indication that tests can be devised which could be successfully used in the selection of men who will be fitted for deep-sea diving.

The cause of this slowing has been variously attributed: To the stimulating effect of the increased tension of oxygen, to the narcotic effect of the increased tension of nitrogen, to the pressure effect alone, and to a purely psychological—not physiological—effect. Many of the earlier authors believed the increased partial pressure of oxygen to be the factor that influences the physiological changes produced by exposure to compressed air; furthermore Damant (4) suggested that the psychological changes might also be thus explained. In support of this oxygen theory, it may be pointed out that most authors believe that the decreased partial pressure of oxygen is the factor that causes both the physiological and psychological changes encountered in altitude work.

Both Phillips (1) and Hill and Phillips (2) state that the psychological changes encountered in deep diving are due to purely mental—not physical—causes. They described several cases of failure of accomplishment under pressure which they demonstrated by psychoanalysis to be due to claustrophobia. The data presented in the present report definitely demonstrates that there is a marked change in response, produced by increased air pressure, that cannot be considered to be caused by a purely mental reaction such as claustrophobia.

Behnke, Thomson, and Motley (3) attribute these psychological changes entirely to the narcotic effect of the increased nitrogen tension. Against this theory is the fact that the greatest change is noticeable immediately upon reaching the pressure and lessens as the subject becomes adjusted. It is well known that if pressure is applied too quickly the diver becomes dizzy and often is so dazed as to require several minutes to orient himself. Consequently, if the cause were nitrogen narcosis, the difficulty would increase with exposure rather than decrease. Also, against this theory is the fact that as the nitrogen tension increases, the oxygen tension also increases proportionately and would, therefore, tend to counteract the narcotic effect of the nitrogen.

The true cause of the slowed mental and neuromuscular activity encountered in high pressure air work has not been satisfactorily demonstrated. It may be a combination of all of the above-mentioned

factors, or it may, in some way, be due entirely to the effect of the pressure itself. Work is in progress at the experimental diving unit which, it is hoped, will shed additional light on the true cause of the mental and neuromuscular changes produced by exposure to increased air pressure.

SUMMARY

Data which included problems, number cross-out tests, and light-to-touch reaction time worked at both atmospheric pressure and under increased air pressures, have been presented.

These data give quantitative evidence of the slowing effect that increased air pressure has upon the normal mental and neuromuscular responses.

Experience in work under pressure tends to lessen this effect, and low mental ability undoubtedly enhances early and extreme failure under high air pressure.

The cause of this effect was discussed.

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THE RELATION OF CARBON DIOXIDE TO ARTIFICIAL RESPIRATION¹

By F. S. JOHNSON, Commander, Medical Corps, United States Navy

The expired air is a mixture of air from the alveoli with the air remaining in the air passages at the end of inspiration, and for all practical purposes the expired air is alveolar air only at the end of forced expiration. Since the alveolar air is in contact, through the alveolar epithelium, with the blood passing through the lungs, the physiologic effect of gases in the air breathed in almost entirely dependent on their gaseous concentration in the alveolar air. Paul Bert (1) was the first to demonstrate that the physiologic action of gases depends on their partial pressure, and all subsequent observa-

¹ From the laboratories of the U. S. Naval Medical School, Washington, D. C.

tions have extended and confirmed his conclusions. It is only when the barometric pressure is constant that the physiologic effects depend on the percentage proportion in which a gas is present.

According to Henry's law governing the solubility of gases in liquids, the amount of gas which goes into simple solution in a liquid is directly proportional to the pressure of the gas above the liquid. By the application of this law to the physiology of breathing, it can be said that the amount of any gas in simple solution in the arterial blood is directly proportional to the partial pressure of the gas in the alveolar air. The method of calculating the partial pressure of a gas in the alveolar air may be illustrated by an example. Let us suppose that 5.6 volumes percent carbon dioxide are found in the alveolar air, and that the barometric pressure is 760 millimeters (1 atmosphere). Since the alveolar air is always saturated with aqueous vapor, and since the pressure exercised by aqueous vapor at body temperature is 47 millimeters, the total gas pressure in the alveolar air would be $760 - 47 = 713$ millimeters. Of this total gas pressure 5.6 percent would be due to carbon dioxide. Therefore, the partial pressure of carbon dioxide in the alveolar air would be $5.6 \times \frac{713}{100} = 39.9$ millimeters, or 5.25 percent of 1 atmosphere, since $\frac{39.9}{760} = 5.25$ percent.

The amount of carbon dioxide in simple solution in the blood can be calculated from the amount, 51 volumes percent, which is known to go into simple solution in the blood when the pressure of carbon dioxide is 1 atmosphere (760 mm). Thus, it is found that with the normal alveolar carbon dioxide pressure of about 40 millimeters, $\frac{40}{760} \times 51 = 2.7$ volumes percent carbon dioxide are in simple solution in the arterial blood. But at this same partial pressure of carbon dioxide, most arterial bloods take up about 53 volumes percent carbon dioxide. It is therefore evident that most of this gas is in chemical combination. Further evidence pointing in the same direction is that although the expired air contains about 4 percent carbon dioxide, the partial pressure of carbon dioxide in the mixed venous blood during rest is only about 6 millimeters higher than it is in the arterial blood. This corresponds to $\frac{6}{760} \times 51 = 0.4$ volume percent. The giving off of carbon dioxide in the lungs is therefore almost entirely dependent on its chemical combination in the blood. The chemical combination is chiefly in the form of sodium bicarbonate, and the ratio between the free and combined carbon dioxide determines the pH of the blood.

By reference to figure I it is seen that at the normal alveolar carbon dioxide pressure of 40 millimeters completely reduced blood

takes up 5 to 6 volumes percent more gas than completely oxygenated blood. The evident explanation is that oxyhemoglobin is more acid than reduced hemoglobin. Figure II, which represents the central portion of figure I, is more illustrative by indicating how reduced blood can actually carry carbon dioxide at a less partial pressure than required by arterial blood. Let us suppose that the respiratory quotient is normal, about 0.82. If the arterial blood contains 18 volumes percent oxygen, the complete utilization of this oxygen

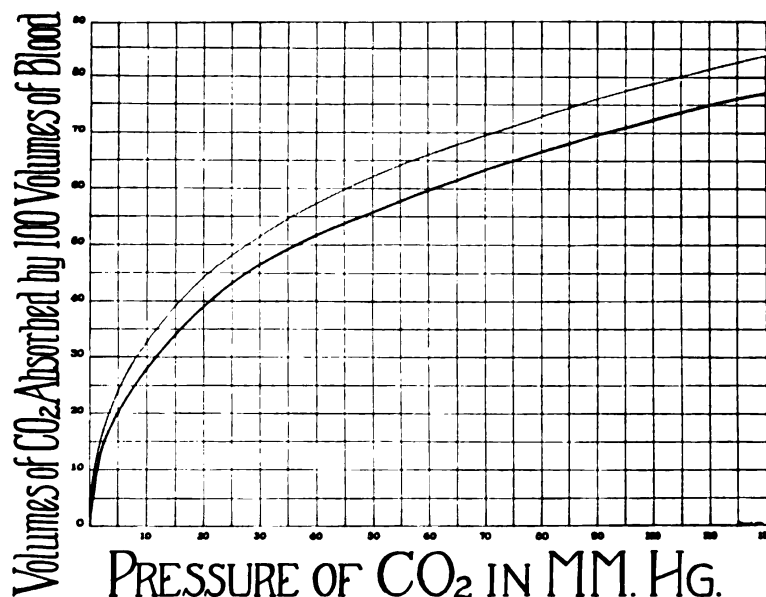


FIGURE I.—The lower curve is the carbon dioxide association curve for completely oxygenated blood. The upper curve shows the association curve of carbon dioxide for completely reduced blood.

would be accomplished by the production of 16 volumes percent carbon dioxide to produce $\frac{16}{18} = 0.82$ R. Q. Figure II shows that the absorption of 16 volumes percent carbon dioxide would follow the straight line from the lower to the upper curve, and that with the reduced blood the 16 volumes percent carbon dioxide would be carried at a partial pressure of only 62 millimeters, whereas a partial pressure of 80 millimeters would be required for the arterial blood to carry an equivalent amount. In other words, figure II not only shows the obvious effect of oxygenation of hemoglobin on the carrying capacity of the blood for carbon dioxide, and vice versa, but it clearly indicates that the alveolar carbon dioxide pressure is an index of the tension at which carbon dioxide is received from the arterial blood by the respiratory center.

The influence of carbon dioxide on the dissociation curve of oxyhemoglobin is shown by figures III and IV. Figure III is the dissociation curve for oxyhemoglobin at a constant pressure of 40 milli-

meters of carbon dioxide. The steep part of the curve is so sloped that it is apparent that a large part of the oxygen is released from oxyhemoglobin with a comparatively small fall in the partial pressure of oxygen. The hemoglobin is normally about 94 percent saturated with oxygen in the arterial blood. By reference to the curve this is found to correspond to a partial pressure of 84 millimeters of oxygen, or 11 percent of an atmosphere. Since at a pressure of 1 atmosphere 2.2 volumes percent of oxygen go into solution in the

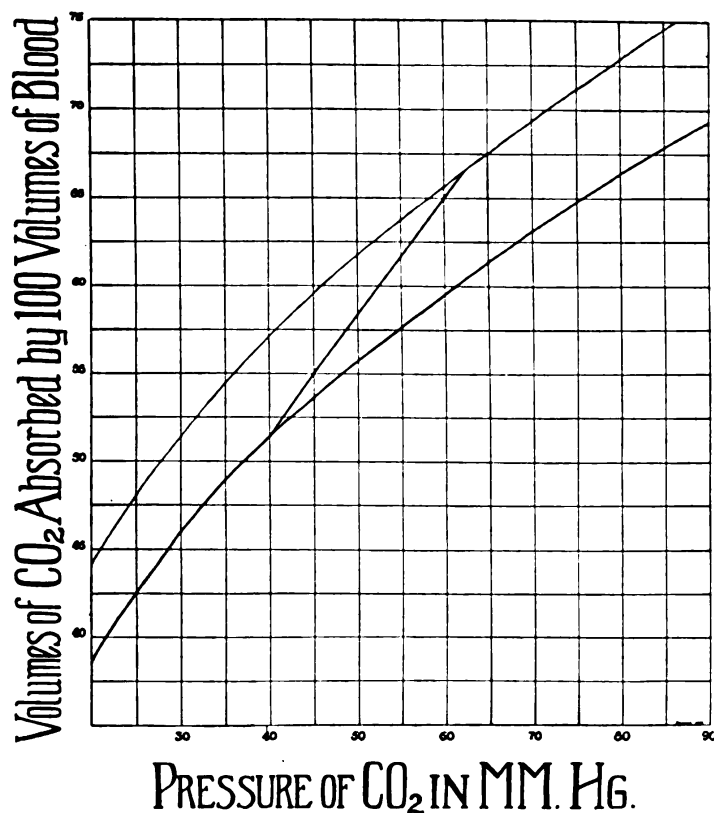


FIGURE II.—The upper and lower curves are reproductions from the central sections of Figure I. The straight line drawn between the upper and lower curves indicates how 16 volumes percent carbon dioxide could be carried by completely reduced blood at a much lower partial pressure than would be required for completely oxygenated blood to carry the same amount.

arterial blood, at the normal partial pressure of 84 millimeters of oxygen only $\frac{84}{760} \times 2.2 = 0.24$ volume percent of oxygen is in simple solution. But the amount of oxygen in simple solution is of essential importance, for it is the oxygen in simple solution which is at all times necessary for the tissue requirements, regardless of how much oxygen is in chemical combination with hemoglobin. The hemoglobin is merely the "storehouse" for oxygen. The plasma is the "supply house."

To Bohr (2) is given the credit for the important discovery of the influence of the partial pressure of carbon dioxide on the dissociation curve of oxyhemoglobin. Figure IV is the dissociation curve

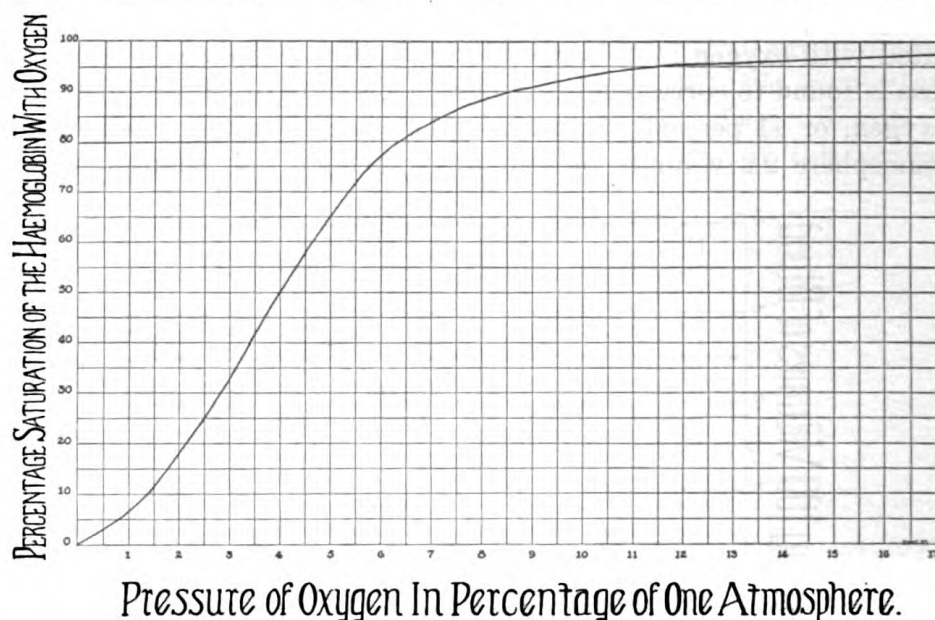


FIGURE III.—Shows the disassociation curve of oxyhemoglobin in blood at a constant partial pressure of 40 mm. of carbon dioxide, and at varying partial pressures of oxygen. Different curves in different individuals vary somewhat, but they all follow the same general pattern.

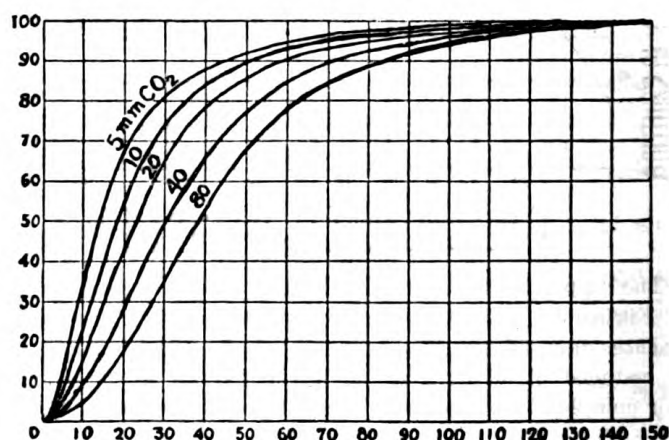


FIGURE IV.—The ordinates show percentage saturation of hemoglobin with oxygen, and abscissae indicate partial pressure of oxygen in millimeters of mercury. The curves represent percentage saturation of hemoglobin with oxygen at different partial pressures of oxygen and carbon dioxide in dog's blood at 38° C. (Bohr, Hasselbalch, and Drogé.)

of oxyhemoglobin at varying partial pressures of carbon dioxide. It illustrates the marked influence of carbon dioxide has on the steep slope of the curve. Increasing the partial pressure of carbon dioxide renders this part of the curve steeper, and in this way causes

oxygen to be released more readily from its chemical combination with hemoglobin with a comparatively small fall in the partial pressure of oxygen. Conversely, a lowering of the partial pressure of carbon dioxide shifts the curve to the left in such a manner that a greater fall in the partial pressure of oxygen is required for the release of an equivalent amount of oxygen from oxyhemoglobin. It is apparent that with a lowering of the partial pressure of carbon dioxide, the hemoglobin may hold on to oxygen so tightly that the tissues may suffer much oxygen lack even when the hemoglobin is so much saturated with oxygen that cyanosis is lacking. On the other hand, by maintaining a high partial pressure of carbon dioxide, there may be marked cyanosis, and yet the tissue requirements for oxygen may be well satisfied. In fact, the living body under normal conditions regulates this gaseous interplay with remarkable success. It is evident that as the blood becomes more and more venous during its passage through the systemic capillaries, and in so doing taking up carbon dioxide, oxygen is given off from oxyhemoglobin more readily than otherwise.

Lorraine Smith and John Scott Haldane (3) were the pioneers in the therapeutics of carbon dioxide. At the same time they were unable to understand the pharmacology involved, since the discovery of the effect of carbon dioxide on the dissociation curve of oxyhemoglobin had not yet been made. But they observed that animals in a comatose state from the anoxemia of carbon monoxide poisoning were revived by the respiration of expired air (expired air contains about 4 percent carbon dioxide), and they noted still more striking results by simply adding carbon dioxide to the inspired air. Haldane subsequently directed attention to the manner in which the adding of carbon dioxide to inspired air can compensate within wide limits for the deficient oxygen pressure which affects aviators at high altitudes.

In America the literature is replete with contributions to the subject by Yandell Henderson. His earnest endeavors to publicize the life-saving qualities of carbon dioxide have resulted in his name becoming near to household familiarity. His contributions to the prevention and treatment of asphyxia in the newborn (4), to measures of lessening the danger of carbon monoxide poisoning (5), and to the use of carbon dioxide in resuscitation from asphyxia and drowning (6), are classics in the annals of medical literature, and against them no dissenting voice can raise a persuasive argument.

The Schafer prone-pressure method of artificial respiration has stood the test of time. But, alone, it can do no more than raise the alveolar oxygen pressure. In asphyxia of all kinds the carbon dioxide pressure is depressed. No excess of carbon dioxide can be pro-

duced when the supply of oxygen is cut off. In fact, the hyperventilation of the lungs associated with the early stages of many forms of asphyxia rapidly washes out carbon dioxide and thus depresses the sensitivity of the respiratory center. A depressed respiratory center is slow to respond to any manual attempt at resuscitation.

A modification (7) of the Schafer prone-pressure method has recently been proposed. This modification is simply accomplished by raising and lowering the arms at the elbows alternately with prone pressure. An evaluation of this method (8) has indicated the possibility of increasing the pulmonary ventilation in the Schafer method by more than 40 percent. But any manual method of artificial respiration, no matter how efficient it may be, has real limitations. The great sensitivity of the respiratory center to carbon dioxide in this connection cannot be too much emphasized. This astounding sensitivity is well attested by the fact that artificial respiration applied to the extent of lowering the alveolar carbon dioxide as little as 0.2 percent below normal is sufficient to cause apnoea. On the other hand, when the alveolar carbon dioxide pressure is raised by only 2 millimeters (9) the breathing is increased about threefold. If the carbon dioxide of inspired air is increased to 4.5 percent, it is impossible to produce an apnoeic pause, however forcefully the artificial respiration may be carried out. There seems no reason to avoid the conclusion that every form of manually applied artificial respiration should be accompanied by the inhalation of carbon dioxide whenever possible.

Yandell Henderson has advocated the inhalation of a mixture of 7 percent carbon dioxide and 93 percent oxygen. For this mixture he has coined the term "Carbogen." The soundness of his advocacy seems to be further substantiated by Arthur Grollman (10), who finds that the cardiac output is not increased with carbon dioxide until the proportion of carbon dioxide in the air breathed is increased to over 6 percent.

There are several forms of apparatus on the market for administering carbogen. Probably the simplest is that devised by Henderson and Haggard. This is marketed under the name of "H-H inhalator", by Mine Safety Appliance Co. The Navy standard oxygen breathing rescue apparatus is so designed that it can be used as an inhalator. Nothing in this report is intended to detract from the value of this rescue apparatus. It is usual, however, that an apparatus designed for a particular purpose is the best for that purpose. It is usually the simplest. For this reason the use of an apparatus of the type of the H-H inhalator is recommended for use in connection with artificial respiration. The arm lift with the Schafer method can be easily applied in association with the use of this apparatus.

CONCLUSIONS

1. Manually applied artificial respiration should, preferably, be accompanied by the administration of 7 percent carbon dioxide and 93 percent oxygen.

2. A type of apparatus simliar to the H-H inhalator and an oxygen-carbon dioxide mixture similar to carbogen are recommended for use in artificial respiration.

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ENDOCRINES

PRESENT DAY CONCEPTS OF ENDOCRINOLOGY

By PAUL F. DICKENS, Lieutenant Commander, Medical Corps, United States Navy, and
OMAR J. BROWN, Lieutenant, Medical Corps, United States Navy

PART III (continued from April issue)

HORMONAL THERAPY

THERAPEUTICS OF OESTROGENIC SUBSTANCES

When reading the literature referable to therapeutic uses of the oestrogenic substances, one must understand that the term refers to the substances which directly produce oestrus and not to substances which indirectly, by stimulating the ovary, produce oestrin. For example, oestrin is a primary oestrogenic substance, one which will

produce oestrus by its own action; while the anterior pituitary gonadotropic hormone may produce oestrus indirectly by its property of stimulating the ovary to produce oestrin.

In general, gynecological organotherapy is extremely disappointing, but the research worker is obtaining more and more information which is of value to the clinician. It is necessary that the physician become intimately familiar with reproductive physiology and the action of the known hormones before he can use these substances in a rational manner. The therapy of oestrin is based upon its physiological action. (1) It is an active principle of the growing ovarian follicle, the interstitial tissue of the ovary, the placenta and the amniotic fluid. It is also found in the urine of pregnant women. (2) It produces growth and hyperemia of the endometrium but does not produce secretory activity. (3) Menstruation follows the sudden fall of oestrin in the blood. (4) Oestrin does not stimulate ovarian activity. (5) Large doses inhibit ovarian activity owing to their depressant effect on the anterior pituitary gonadotropic hormone, and may even produce atrophy of the ovary. (6) The best evidence indicates that oestrin is responsible for the normal regular rhythmic contraction of the uterine muscle. Follicle ripening with the secretion of oestrin, followed by luteinization with the production of progesterin, are due to the action of the gonadotropic hormone, or hormones, of the anterior pituitary gland.

Some of the preparations of the oestrogenic hormone, commercially available, are (1) theelin, in aqueous solution (Parke-Davis & Co.), (2) theelin in oil (Parke-Davis & Co.), (3) amniotin in corn oil (E. R. Squibb Sons Co.), (4) progynon in water (Scherring), and (5) progynon (B) in sesame oil (Scherring). All of these are primary hormones and must be used by intramuscular injection. Hormones available for oral administration are: (1) theelol in capsules, (2) amniotin in capsules, (3) progynon in tablets. The unit of dosage in America is the Allen-Doisy rat unit, that quantity of oestrin which, when divided and given in three injections at 4-hour intervals, will provoke oestrus within 3 days in an ovariectomized, sexually mature rat of a standard weight (120–160 grams). This is a laboratory test, consisting in the finding of cornified cells in vaginal smears. The international unit, in accordance with the League of Nations, is one-fifth the Allen-Doisy rat unit.

All true hormones must be administered parenterally, for oral products, as has been said before, while more pleasant to the patient are less reliable owing to the possibility of breakdown and change incident to the process of digestion. Suppositories, nasal sprays and other preparations have been used but they are disagreeable and unreliable.

THERAPEUTIC APPLICATIONS

Amenorrhea.—Amenorrhea is the absence of menstruation during the reproductive period of life. All constitutional disorders (such as malnutrition and tuberculosis) which may be accompanied by amenorrhea must be ruled out by a careful physical examination and clinical study before instituting oestrin therapy.

Oestrin has no physiological effect on the ovary, therefore the priming of the endometrium by progestin does not occur. Hence, it takes very large amounts of oestrin to build up the endometrium so that bleeding will occur. Even so, this may not be a true menstruation. It seems that the giving of large doses of oestrin, coupled with its sudden withdrawal, has at times produced definite menstruation, but this can occur only when the endometrial changes incident to the action of progestin have taken place. The present accepted method of treatment of amenorrhea is to treat first with the gonadotropic hormone and then follow with oestrin. The physiology behind the use of the anterior pituitary sex-like hormone (gonadotropic hormone) is that it stimulates the maturation of the Graafian follicle and corpus luteum formation which in turn produce their own progestin and oestrin. Following this, if oestrin is given and then withdrawn, menstruation should occur.

Functional uterine bleeding.—The general belief is that functional uterine bleeding is due to a relative increase in the oestrogenic substance and a relative decrease of progestin. Therefore it would seem that oestrin is contraindicated in this condition. Clinically the condition is more successfully treated by the use of the anterior pituitary sex-like hormone derived from pregnancy urine. The physician must keep in mind the various theoretical causes for this decrease of progestin and relative increase in oestrin. They are: (1) An insufficient quantity of the anterior pituitary gonadotropic hormone (prolan) to stimulate the ovarian follicle to maturity. This results in a failure of the corpus luteum to form and, of a necessity, a lack of or deficiency of progestin. The endometrium here is hyperplastic with a cystic glandular formation of the typical "Swiss-cheese" pattern. This type of bleeding is due to a hypofunction of the pituitary. (2) An ovarian disturbance in which the follicles become cystic and no corpus luteum is formed owing to failure of the cysts to rupture. Here there is no deficiency in prolan and there is no "Swiss-cheese" pattern of the endometrium. Instead, the endometrium is thickened and decidualike in character. (3) Preclimacteric changes in which there is no insufficiency of the pituitary but structural changes in the ovary prevent corpus luteum formation and the elaboration of progestin (similar to the second type above). In this type nature attempts to correct the deficiency of the ovaries by a com-

pensatory hypersecretion of prolactin by the pituitary. The excessively large amount of the sex-like hormone in the blood of these cases can be demonstrated and at times may even reach the height sufficient to give a positive Aschheim-Zondek test.

Novak has summed this up with the statement that functional uterine bleeding seems to be due to an imbalance between two hormones—a relative increase in oestrin and a deficiency in progesterin.

Vasomotor symptoms of the menopause.—Here we have rational grounds for the use of oestrin in the plan of treatment. It is in the period of the established menopause that oestrin is at its lowest level in the human body. Hence the required dosage is large and it is best to begin with intramuscular injections and later switch to oral administration. When the vasomotor symptoms, hot and cold flashes, the psychic depressive symptoms and emotional disturbances, are coming thick and fast, it is best to give this drug by daily injection until the symptoms are brought under control. The initial dosage, which should not be less than 2,000 rat units a day, is gradually reduced as the symptoms subside. When the oestrogenic hormone is raised to the optimum level the nervous manifestations will be brought under control and the relief of these patients can be practically guaranteed if one is able to introduce sufficient substitution therapy. In many cases the oestrogenic hormone in this condition is practically as specific as insulin is in diabetes.

In elderly women who have already passed through the menopause, all the distressing symptoms of this phase of the female sex life may recur owing to the development of a granulosa cell ovarian tumor which contains large amounts of the oestrogenic factor, and they will be relieved only upon the surgical removal of such a tumor.

Gonorrheal vaginitis in children.—In view of the fact that oestrin produces pronounced proliferation of the vaginal epithelium in immature animals with desquamation on the discontinuance of the injections, it is no wonder that gynecologists have resorted to oestrin in the treatment of this dreaded infection in children. Reports have shown that vaginal proliferation can be produced in children by this method of treatment.

There are still two questions to be decided. First, the rapidity and permanency with which the gonococci can be made to disappear; and, second, the injurious by-effects produced by the injection of necessarily large doses of the hormones on the immature child. Treatment should be continually checked by bacteriological study of vaginal smears to determine the rapidity of disappearance of the gonococci. Gonococci must be absent for at least 1 week, as determined by daily smears, in order that the patient may escape the relapses so characteristic of this disease and in order that the case may be considered cured.

Dr. Novak states that the enlargement of the breasts which occasionally occur with the use of oestrin, disappears rapidly upon the withdrawal of treatment. He also states that with the dosage usually used (50 rat units daily) he has not noted uterine bleeding upon the withdrawal of treatment. The reports show that the duration of this treatment varies, the average being about 21 days. If this treatment is used, local treatment must not be used. The method holds great promise, and its employment in the treatment of gonorrheal vaginitis in children is proper.

Hemophilia.—The literature on the therapeutic use of the oestrogenic hormones and ovarian substances in hemophilia is definitely contradictory. A number of authors have reported good results in using ovarian preparations commonly believed to be practically inert. Other authors, who checked their cases by laboratory study, failed to get any benefit whatsoever. If giving oestrin causes uterine bleeding, it is hard to see how under this condition it could act to stop hemorrhage. While these substances may be given a trial, they should be combined with the accepted method of treatment—symptomatic and blood transfusions—and above all no promise of a cure should be given.

Dysmenorrhea.—Dysmenorrhea may be either primary, due to hormonal deficiency, or secondary, due to pelvic pathology. On the basis of Kennedy's view that the symptoms of primary dysmenorrhea are due to changes in Frankenhauser's ganglion resulting from a deficiency in oestrogenic substances, the use of oestrin has been given a clinical trial. When used, oestrin should be administered in the mid-interval period and not just before menstruation and in doses of 2,000 rat units twice weekly which are discontinued just prior (2 days) to expected menstruation. This allows the oestrin content of the blood to fall and menstruation to take place. This is based on the supposition that high blood oestrin combined with progestin desensitizes the uterus to oxytocin and allows the completion of progestational changes which are painlessly sloughed off at menstruation. Thus, from a physiological standpoint, it would seem that the progestational hormone, progestin, should be given conjointly with theelin. We have used theelin and lipo-lutin (progestin) with considerable success.

Sterility.—Sterility denotes the failure of a biologically viable spermatozoa to meet a biologically viable ovum. In other words, conception does not take place. On the other hand, infertility implies that conception takes place but it does not progress. Here we are concerned only with the endocrine factors of sterility and not with mechanical defects, antagonistic cervical secretions, and other definite pathological conditions which prevent conception.

As will be noted under the therapeutic use of the corpus luteum hormone, progestin, the treatment of sterility by use of the hormones

now available is on a most unsatisfactory scientific basis. Theelin, as a shot in the dark, will rarely be successful unless the sterility is due to a definite deficiency of this hormone, in which case it should be used in large doses (1,200 rat units by mouth or 300 rat units intramuscularly) daily for a period of 2 to 3 weeks. One rat unit intramuscularly is as effective as from 4 to 7 rat units by mouth. The literature leads one to believe that many cases of sterility may be cured by advising the patient as to the proper time for sexual intercourse as determined by a careful study of the woman's menstrual cycle to determine the probable date of ovulation—usually from the tenth to the fifteenth day after the first day of the previous menstruation in a woman with a 28-day cycle. It is unnecessary to discuss the necessity of there being potentially fertile ova and spermatozoa. Means of determining that a spermatozoan is viable are most unsatisfactory since motility does not necessarily indicate ability to fertilize an ovum.

Mazoplasia.—Mazoplasia is a painful physiological hypertrophy of the breasts. The epithelial cells in the ducts and acini desquamate and the connective tissue hypertrophies. Nodules which vary in size with the menstrual cycle may be palpated. It is important to note that neither cysts, papillomata, nor carcinoma follow mazoplasia. Discreet fibro-adenomata are probably the result of the condition.

Satisfactory results have been reported in the treatment of this condition by the use of 1.0 cubic centimeter of theelin daily for 5 days preceding the menstrual period. The explanation of this is unknown and certainly is not in harmony with the present concept of the physiology of this hormone. At times feedings with whole ovary (3 grains three times a day) does seem to have some beneficial results.

Summary.—(1) The oestrogenic hormone is of little value in amenorrhea. (2) In the treatment of the early menopausal symptoms especially the psychic and vaso-motor phenomena, theelin is the remedy of choice.

(3) In gonorrheal vaginitis in the young child the use of the oestrogenic hormone is definitely worth while.

(4) At present the use of oestrin in hemophilia does not live up to its reputed value.

(5) In sterility it may be used empirically in a trial-and-failure method. The results are uncertain.

(6) In dysmenorrhea the beneficial results are at times spectacular, at other times a complete failure.

(7) In mazoplasia, or painful breasts, the intramuscular use of oestrin may, according to some authors, produce favorable results. This is in contradiction to the present concept of oestrin in producing growth of the breasts and such therapy seems most illogical.

(8) Oestrin should not be used in the male patient, since it may produce atrophy of the testicles.

(9) The use of theelin has been reported to have relieved a case of epilepsy of 5 years' duration which appeared 6 months after cessation of menstruation. Its action in such a case remains unknown if the diagnosis was correct.

THE GONADOTROPIC HORMONES

Smith in this country, and Aschheim and Zondek in Germany, aroused enormous interest in anterior pituitary organotherapy when they discovered the remarkable effects produced upon the gonads of experimental animals by anterior pituitary implants. The second impetus given to organotherapy resulted from Zondek's discovery that the urine of pregnant women contained large quantities of a substance he named "Prolan." Zondek believes this substance to be identical with the gonad-stimulating hormone produced by the anterior lobe of the pituitary. The universally used pregnancy tests (Aschheim-Zondek and Freedman) are based upon the presence of this factor in the urine during all stages of pregnancy.

There has been much discussion as to the unity or duality of the gonad-stimulating principle of the anterior pituitary. Many investigators look upon Prolan-A and Prolan-B effects as being different phases in the activity of a single principle. However, it seems best to look upon these effects as being due to two principles, Prolan-A and Prolan-B, as outlined previously.

For therapeutic uses there are several preparations available, such as Antuitrin-S (Parke-Davis & Co.), and Follutein (E. R. Squibb Sons Co.). These preparations are made from the urine of pregnant women but vary considerably in their rat unit content. Antuitrin-S contains 100 rat units per cubic centimeter, while Follutein contains 1,250 rat units per cubic centimeter. Also Follutein is put up in a glycerine solution and before administration 1.0 cubic centimeter must be diluted with 9.0 cubic centimeters of sterile water, thus making 125 rat units per cubic centimeter.

The rat unit is defined as the minimum amount which, when given in six injections on 3 consecutive days, produces mature follicles and one or more corpora lutea in the ovary of a 30-day old female rat in less than 100 hours after the first injection.

CLINICAL APPLICATION

Functional menorrhagia.—This very frequent disorder may be encountered at any age during the reproductive period—during puberty, adolescence, or, more often, at or near the menopausal phase. Clinical experience shows the definite therapeutic value of the an-

terior pituitary-like principle derived from the urine of pregnant women which frequently acts almost as a specific. Originally the use of this hormone was based on the theory that corpus luteum and progesterin were lacking and it was thought the lack of the luteinizing principle, Prolan-B, of the anterior lobe of the pituitary was the chief cause. In an attempt to supply this deficiency of Prolan-B the luteinizing principle found in the urine of pregnant women was used, since experimental evidence showed that such a substance produces marked luteinization in mice and rats. By analogy, it was thought that the human follicle could be luteinized and progesterin thus produced with the completion of the menstrual cycle and cessation of bleeding.

Since these experiments, however, the ovaries of patients who have received the gonadotropic hormone have been studied, and it has been shown that the response is not at all similar to that found in experimental animals. In the human, luteinization is not produced. Yet the abnormal bleeding, in a large proportion of the cases treated, is definitely controlled although the exact mechanism of the action of the hormone is at present unknown. (See oestrin therapy above.) It is obviously in some way connected with the reciprocal function of the anterior lobe gonadotropic hormone and the ovaries.

The chief indication for gonadotropic hormone therapy in functional bleeding is in younger women in whom any form of radiotherapy is undesirable. Why the treatment is so strikingly successful in some cases and so unsatisfactory in others, one cannot say. At present it is believed that many of the failures are due to low potency of the preparations used, this hormonal preparation, above all others, being notoriously prone to deterioration even with the best refrigeration. When it is found necessary to treat this type of hemorrhage, radical treatment must be instituted, i. e., daily intramuscular injections of 100 to 200 rat units. In some instances the results are spectacular, the bleeding being checked within a period of hours. In marked hemorrhages there is no objection to using the preparation of two manufacturers on the same day. No method of hormone treatment yields such a large proportion of successes as follows the employment of the anterior lobe gonadotropic sexlike hormones in functional bleeding. In passing it is important to note that bleeding checked by this agent is not necessarily an indication that the bleeding is functional.

No method of treatment is uniformly successful, however, and alarming recurrences in young women and children may occur, transfusion not infrequently being necessary. In fact, in some clinics blood serum of pregnant women is used in the treatment of recurrences. Reports in the literature have shown that a combination of

intramuscular injections of this hormone, with injections of blood serum of pregnant women and rectal infusions of urine of pregnant women, may be effective. Curretage, hormonal therapy, and blood transfusions, all combined, may be necessary in some cases, but bed rest and large doses of hormone are usually sufficient.

The physiological action of the anterior pituitary sexlike hormone is that it produces enlargement, rupture, and luteinization of the follicles and opening of the vaginal canal and production of oestrus in animals. Further, it produces true corpora lutea and also distension of the uterus. Its action, therefore, is exerted directly on the ovary, causing this organ to fulfill its full physiological function provided there is no hormonal imbalance in the ovary. From this it will be seen that no clinical results could be expected in castrates, in women with atrophied ovaries, or when the menopause has definitely been established.

Undescended testicles (inguinal cryptorchidism).—This condition, the arrest of the descent of the testicles may be either unilateral or bilateral; however, it is usually unilateral. The testicle may be arrested in either one of two places, (a) within the abdominal cavity, or (b) within the inguinal canal. The descent of the testicle is under the direct control of the anterior pituitary gland. The symptoms of abdominal cryptorchidism are sterility, obesity, feminine type of pelvis, and a high-pitched voice—eunuchoidism. The symptoms of inguinal cryptorchidism are only those of sterility.

The treatment of this condition with the gonadotropic or anterior pituitary sexlike hormone has given most satisfactory results in producing a descent of the testicle into the scrotal sac and is now an accepted method of treatment. The dosage given is 200 rat units of anterior pituitary sexlike hormone three or four times a week, and at times in the abdominal type it is coupled with small doses of thyroid extract (one-half grain daily). Treatment should never be continuous. It should be interrupted, never more than 20 doses being given during any period, to be followed by a 2-week rest period.

In our clinic at the Naval Medical School these testicles have descended only after production of a hydrocele of the cord. When treatment was stopped the fluid of the hydrocele was absorbed and the testicle has remained in the scrotal sac in all cases.

Surgery is not indicated in this condition unless a hernia or tumor is present as a complicating factor.

In the treatment of undescended testicle it must be recalled that frequently unilateral inguinal cryptorchidism will spontaneously correct itself at puberty—that is to say, when the sex hormone of the

individual reaches its ascendancy—and undue enthusiasm should not lead us astray in too early treatment of these cases.

Hermaphroditism.—This is taken up merely to debunk the lay press. Generically the term means a resemblance to Hermes and Aphrodites. If the gonads are ovaries, the patient is a female; if testicles, he is a male. Sex is not determined by the secondary sex characteristics and contrary to the lay press no operation can produce a true male from a female or a true female from a male gonad.

A true hermaphrodite would be a patient in which there are fully developed and functioning ovaries and testicles. Pseudo-hermaphroditism occurs in an individual possessing testicles but who has external genitalia resembling those of the female and with certain secondary sex characteristics of the female, or the possession of ovaries with masculine features. This second type, however, is rare. In the final analysis it is probably the interstitial cells of testicles and ovaries which determine the sex.

In the most common type, where an individual has testicles with feminine characteristics, the penis is rudimentary, is devoid of a urethra, and the urinary meatus lies at the base of the penis. The scrotum is ununited and the testicles lie high in the separate folds, exactly resembling labia majora which give the erroneous impression that the patient is a female. Such testicles are apt to become malignant. There is no medicinal treatment.

Menopause.—At the occurrence of the natural menopause a true pituitary dysfunction is said to exist. There is an undersecretion of the growth hormone and a hyposecretion of the hormones controlling metabolism, in addition to a temporary hypersecretion of the pituitary sex hormone. This results in hypothyroidism, atrophic changes, and hypoovarianism with the gradual cessation of menstruation. Thus the anterior pituitary sexlike hormone would seem to be contraindicated. During the early stages of the menopause the use of the anterior pituitary sexlike hormone, early in the intermenstrual cycle, followed by the oestrogenic hormone in the latter 2 weeks of the cycle, will at times relieve patients where oestrin alone will not.

The common belief that irregular bleeding out of the usual menstrual cycle heralds the menopause is a dangerous assumption as such patients definitely warrant investigation to determine the presence of benign or malignant tumors. The menopause is not present until the cessation of menstruation and the onset of nervous manifestations. The latter may be mild or severe. After the true menopause has been established the pituitary sexlike hormone is contraindicated as there is already an excess of this hormone in the blood. The treatment here is the follicular hormone as has been said before.

THE ASCHHEIM-ZONDEK TEST

This is a time-proven biological test for pregnancy and is based on the fact that pregnant women excrete in their urine large amounts of the anterior pituitary hormone, prolactin. This urine, when properly treated and injected into virgin, immature, female mice (mice between 3 to 4 weeks of age and not weighing over 8 grams) induces certain definite developmental changes in the ovary.

Four mice are used for the test, each mouse receiving an injection of 0.5 cubic centimeters of the prepared urine three times a day for 2 successive days. For these injections a tuberculin syringe and a small needle are used. Between 72 and 96 hours after the initial injection all mice are autopsied and their ovaries examined for developmental changes which consist of hemorrhagic follicle formation or corpora lutea development.

INTERPRETATION

Negative reaction.—No hemorrhagic follicle or corpus luteum formation.

Reaction I.—Enlarged Fallopian tubes with deep-seated follicles not visible to the naked eye. This reaction is not conclusive but is suspicious and the test should be repeated.

Reaction II (positive).—Here hemorrhagic follicles, pinhead size or larger, are present which may be seen by the naked eye and should always be visible by a hand lens of 10 magnifications. Two or more hemorrhagic follicles must be seen for the test to be called positive.

Reaction III (positive).—This is the corpora lutea reaction. These are the yellow bodies or corpora lutea which develop following rupture of the follicle. With one mouse showing corpora lutea and another mouse showing hemorrhagic follicles there can be no doubt but that the test is positive.

It must be definitely remembered, however, that at times false positive results occur in women during the early menopausal changes owing to the high content of the sex hormone in the blood during this period. Also occasionally the same result is obtained in cases of delayed menstruation, provided the urine is collected just prior to the onset of the menses. At this school the Aschheim-Zondek test has given a correct diagnosis in approximately 98 percent of the cases—most errors being on the negative side. In addition to being a biological test for pregnancy, it is also a valuable diagnostic aid in the determining of the presence of teratomata, in both the male and female, chorionepithelioma, hydatidiform mole, and in some cases even of certain bleeding carcinomata of the cervix or uterus. In adapting this test for the study of neoplastic diseases it was found necessary to develop a quantitative method of estimating the number of hormonal units present in a liter of urine.

In both normal man and woman it has been established that, in terms of mouse units, the excretion of the gonadotropic substance

amounts to from 5 to 10 mouse units per liter of urine. In the routine Aschheim-Zondek test it will be remembered that 3.0 cubic centimeters of urine are injected in each mouse—0.5 cubic centimeters three times a day for 2 days. If after 72 hours the characteristic changes in the ovary are observed it is assumed that the 3.0 cubic centimeters of urine contains at least 1 mouse unit and a liter of this urine a minimum of 333 mouse units. If a positive test is obtained with the same urine diluted 1:10, it follows that it contains a minimum excretion of 3,330 units per liter; a 1:100 dilution, an excretion of 33,300 units, and so on. If the test with the undiluted urine is negative, it is assumed that the 3.0 cubic centimeters injected contain less than 1 mouse unit. If the same urine is then extracted to one-third of its original volume before a positive test is obtained, the method of administration and dosage being the same, it indicates that the original urine contained only 111 units per liter. In other words, it takes 9.0 cubic centimeters of the undiluted urine to contain 1 mouse unit. Thus, by means of dilution or concentration it is possible to determine quantitatively the number of units of the gonadotropic substance present.

As has been said, the amount of this substance present in normal pregnancy rises sharply from 5,000 to 20,000 mouse units per liter. If the output exceeds 20,000 mouse units it is taken as indicative of a pathological pregnancy such as hydatid mole or chorionepithelioma. In the male a routine positive test is indicative of a teratoma regardless of the quantitative figure. The concentration in malignancy is dependent upon the embryonal character of the tumor, the extent of the disease and the status as regards treatment. Therefore quantitative estimations are of great value in checking the therapeutic results of surgery and of X-ray in any of these conditions.

The rapidity with which the hormone disappears from the urine after extirpation of the primary tumor, in cases without metastases, is not definitely known. Frequently, however, within 2 weeks the urine is normal and certainly within a month it should be. If after surgery and irradiation the results are negative and repeated tests at intervals show this substance gradually returning in the blood so as to give a positive test, it indicates reactivation at the primary site or active metastasis. If the test remains consistently negative, clinical cure may be assumed.

CORPUS LUTEUM

Broadly speaking, the exact function of the corpus luteum hormone is not definitely understood; but in general it acts to prepare the endometrium of the uterus to receive the fertilized ovum and nourish the developing embryo. This is accomplished by the changes

it brings about in the histologic structures of the uterus and the secretory action of the uterine lining. Furthermore, in some way the hormone sensitizes the endometrium to the presence of the embryo, so that it responds by the formation of the maternal part of the placenta and decidua. The hormone of the corpus luteum which brings about these changes has been named "progestin" or "corporin."

Besides these effects on the endometrium, the corpus luteum is also thought to produce certain effects on the uterine muscle. At present some believe that it renders the uterine muscle temporarily quiescent by inhibiting the effect of the oxytocic principle of the posterior lobe of the pituitary gland. This is the action of the hormone which we have described as "desensin"; but it must be remembered that whether such a definite hormone as desensin actually exists or whether this is merely another action of oestrin is still unsettled. The relaxation of the pelvic ligaments by another specific hormone, "relaxin", also is still not proved.

As far as is known at the present time, the corpus luteum has no useful action except in early pregnancy; but in most mammals, including man, it is formed during every cycle in anticipation, it would seem, of pregnancy. Thus in the adult nonpregnant human female it is acting about half the time producing the so-called premenstrual stages of the endometrium. In mammals with less frequent cycles naturally the period of corpus luteum activity is less.

Progestin has been extracted from the ovaries of swine and is a true hormone in the sense that it cannot be given orally because either it is not absorbed from the gastro-intestinal tract or it is inactivated by the processes of digestion. The unit of dosage is the rabbit unit. The standard assay of progestin is performed by administering it for 5 days to an adult rabbit that has been mated and then castrated. The rabbit unit in America, according to the Corner and Allen method, is the minimum quantity which, when divided and given in five equal daily doses, produces on the sixth day a state of the uterus corresponding to that of the eighth day of normal pregnancy. In Germany another unit, the Clauberg, is used. This unit is slightly smaller than the American unit. It is assayed in the same way, except that immature rabbits of 600 grams weight are used, they being primed first with 10 daily injections of oestrin before the 5-day course of progestin. Progestin of a certain purity has recently become commercially available.

CLINICAL APPLICATION

Sterility and habitual abortion.—When this condition is due to a uterine disturbance caused by deficiency of the corpus luteum hormone, progestin will help these patients by bringing about an ade-

quately prepared endometrium. Employed as a therapeutic test, it will be useful in classifying such cases. On the other hand, if corpus luteum prevents ovulation, as many investigators believe, then, in cases of sterility from this cause, an ovarian dysfunction resulting in a hypersecretion of progestin, it is distinctly contraindicated.

Metrorrhagia and menorrhagia.—With regard to the treatment of disorders of menstruation, it is difficult at present, with our limited knowledge of the part played by the corpus luteum in the menstrual cycle, to believe that it is primarily connected with the menstrual rhythm. However, partially favorable reports have come from Germany in the treatment of metrorrhagia and menorrhagia including "juvenile uterine hemorrhage", ovarian bleeding without pathological observation, and glandular hypoplasia with bleeding. If these reports are correct, the effect may be due to the known power of progestin to produce an adequate hyperplasia of the endometrium in anticipation for the embedding of a fertilized ovum. If the ovum is not fertilized, embedding does not occur with the result that there follows a normal sloughing and normal menstruation coincidental with the fall of oestrin in the blood. Owing to the difficulty in getting known corpus luteum extracts for clinical use, indirect corpus luteum therapy has been proposed by using the anterior pituitary-like luteinizing factor of pregnancy urine—antuitrin S, or follutein. While this substance has been highly effective in producing corpora lutea formation in mice, it has not produced the same phenomena in monkeys or man. Therefore, if favorable results have been obtained with the use of this substance, it scarcely can be considered as due to the action of corpus luteum.

THERAPY OF THE ADRENAL MEDULLA HORMONE (EPINEPHRINE)

The vasomotor action of epinephrine renders it exceedingly valuable in combating circulatory collapse, especially that seen following trauma or anesthesia. Its effects, however, are shortlived and it is usually supplemented with procedures which give more lasting results. If used as an emergency measure, it frequently must be given more than once, being repeated until the improved circulatory mechanism leads to recovery or until effective treatment by other means has been substituted. For such treatment, 2 to 3 minims of a 1:1000 solution, well diluted with normal saline, given intravenously, is the usually accepted dose. Doses larger than necessary to elevate the blood pressure may lead to serious consequences. The heart, in shock, may not be able to withstand the sudden markedly increased pressure resulting from the powerful vasoconstriction and a fatal acute dilatation might ensue. It must also be remembered that while the accepted dose of epinephrine elevates the

blood pressure, its vasoconstriction action retards capillary circulation, so that the blood flow through important structures may be decreased at the very time when it is not desired. Therefore, it is generally advantageous to increase the volume of circulating fluid by intravenous injection of normal saline or saline and glucose. While there are reports in the literature of large doses of epinephrine being given without undue symptoms (sweating, cardiac palpitation, muscular tremors, collapse, or more serious consequences), it is best to proceed with small doses and repeat as needed to obtain the therapeutic effects desired.

Epinephrine has become an important and widely used agent in the many branches of medicine. In asthma, hay fever, urticaria, angioneurotic oedema, and serum sickness, it has proved helpful. Its use by the dental surgeon and the otolaryngologist is well known, as is its synergistic action when combined with other drugs used as local anesthetics. It has been recommended in cases of Stokes-Adams syndrome in doses of 5 to 8 minims of a 1:1000 solution subcutaneously. It has been used also to control internal hemorrhage; but frequently, owing to the increased systemic blood pressure, increase instead of suppression of the bleeding may occur. Obviously, we cannot here review all the therapeutic uses to which epinephrine has been put; but it must be pointed out that in Addison's disease, a condition in which hypotension is marked, no benefits are derived from its use.

THERAPY OF THE ADRENAL CORTEX HORMONE (CORTIN, INTERRENALIN)

Cortical extracts have been obtained of sufficient potency to maintain totally adrenalectomized animals in apparently normal health. However, the cost of commercial preparations and their tendency to deteriorate render impracticable their use in the treatment of human disease at this time except in the acute crises of Addison's disease where it is combined with the liberal administration of sodium chloride alone. Animal experimentation shows that sodium chloride will prolong life in adrenalectomized dogs for at least five months, but it is recognized now that a certain amount of the cortical hormone is essential for the proper metabolism of salt and water and consequent health over longer periods of time. Hence, logically it would seem that even a small amount of the cortical extract would be better than none. Nevertheless the limited clinical experience with this hormone has failed to show any demonstrable benefit from daily doses of 10 cubic centimeters or more of the commercial extracts now available in cases of progressive adrenal deficiency.

THERAPEUTICS OF PADUTIN

Padutin is a complex molecular substance, believed to be excreted by the pancreas, which produces definite vasodilatation. Evidence at present is that this substance does not contain histamine, adenosin or adenylic acid in sufficient quantities to explain its physiological activity. Clinical reports show that in patients suffering from arteriosclerosis, arteritis, erythromelalgia, pernio (inflammation and swelling of toes and fingers from cold), angina pectoris, Buerger's disease, Raynaud's disease, and intermittent claudication, marked improvement is observed. In cases of arterial disease due to diabetes, myalgia, and ischemic neuritis the results have not been so favorable. Padutin is given intramuscularly, as a rule, in doses of 1 to 2 cubic centimeters twice daily (each cubic centimeter containing 2 units) for 2 weeks. Injections are then given one to three times a week for 10 weeks, or longer, depending upon the clinical observation. Other forms of therapy as indicated are carried out at the same time in all cases.

THYROID THERAPY

As in all hormone-producing glands, the disorders of the thyroid can only be manifestations of either hypo- or hyperactivity of this gland. The normal physiological function of the thyroid is the production of its oxidative hormones. These hormones are contained in the gland proper as well as in the acini. The thyroid produces thyroxin, thyroglobulin, iodothyron, and di-iodotyrosin. Di-iodotyrosin is a biological antagonist of thyroxin. All hormones from the thyroid are noted for their content of iodine, therefore the thyroid gland functions as a regulator of iodine metabolism. The thyroid usually responds to inadequate iodine supply by the storing of iodine-containing colloid in order to preserve this substance which results in an enlarged gland. Timely administration of iodine results in a recession. When an excessive demand for hormones is made upon the thyroid this gland reacts by proliferative changes and loss of colloidal material. Again, with adequate supply of iodine, proliferation ceases and the colloid content of the gland returns to normal.

As important as the thyroid gland is to metabolism, it is not absolutely necessary to life as is demonstrated by its congenital absence, pathological destruction, or total ablation. Taking the sole function of the thyroid, so far as known, to be the manufacture of thyroid hormones, one must consider the physiological action of these hormones and understand their relationship with metabolism, growth, irritability, and homeostasis.

Hyperfunction of the thyroid.—This condition is known variously as thyrotoxicosis, toxic goiter, or exophthalmic goiter. Here thyroid hormone therapy is contraindicated; the problem is not one of substitution therapy but is that of reducing the activity of a hyperfunctioning gland. The only known procedure that can accomplish this permanently is surgical resection. Contrary to the belief that one may become refractory to iodine treatment, it is now believed that there is no true refractoriness to this drug. A patient who does not respond to iodine therapy either does not have a hyperfunctioning gland or is receiving insufficient iodine. The iodine response is now looked upon as a cardinal manifestation of the disease, and if a patient is kept continuously under the influence of sufficient iodine, the course of the disorder will be milder but not shorter. The administration of iodine may be taken advantage of in the determination of the diagnosis as well as in the treatment. Iodine produces a fall in the metabolic rate, a fall in the pulse rate, and general improvement of all symptoms of thyrotoxicosis. Adequate doses of iodine may be given in a saturated solution of potassium or sodium iodide and there is no special advantage in Lugol's solution over any other palatable preparation of iodine. The dose usually given is 5 to 10 minims daily of the saturated solution of potassium or sodium iodide. It should be remembered that no operative procedure should be undertaken on a patient with a hyperfunctioning thyroid gland until the surgeon has been assured that there is an adequate storage of glycogen in the liver.

Hypofunction of the thyroid.—Here we are dealing with a deficient thyroid function and the indicated therapy is sufficient thyroid extract to keep the patient free from all symptoms. There is nothing gained by raising the basal metabolism rate to normal standards. More thyroid extract is required in the winter than in the summer. Thyroxin has no place in medicine and has no advantage over whole thyroid gland. It is inferior when given by mouth and is dangerous if given intravenously. It is not out of place to mention that all dried glands do not contain the same amount of active principle. For instance, Parke-Davis, Armour's, Lederle's, and Lilly's products correspond to the U. S. P. standard and the dose may be from 1 to 2 grains daily, while those of Burroughs and Wellcome do not correspond to the U. S. P. and the dose is higher.

The results of adequate therapy are striking; the patient feels warmer, his sensorium becomes alert, his speed and muscular movements become faster, and above all, he is less sleepy. There is usually a striking diuresis and the bloated appearance disappears. These patients before treatment may show a profound anemia of the secondary type, which at times may resemble pernicious anemia. Here in

addition to thyroid therapy iron and liver are indicated. The heart may be enlarged and albuminuria may occur but digitalis is of no avail. In the cretin the treatment is similar to that outlined above for the adult, but must be started early in life and a sufficient amount given to allow for a normal rate of growth. One should keep in mind that a cretin is athyrotic from birth and treatment must be continuous. The proper treatment of colloid goiter is prevention. For nodular goiter there is no medical treatment, and the probable proper treatment is surgical removal. This is certainly premalignant treatment.

Conditions other than thyroid Dysfunction.—The thyroid hormones may be used in the form of the dried gland in a variety of disorders with beneficial results. To enumerate a few, they are:

1. *Hypometabolism.*—In patients with a low metabolic rate we may have mental depression, arthritis, vasomotor rhinitis, or even recurring corneal ulcer which respond favorably to thyroid medication.

2. *Skin diseases.*—Certain skin diseases are characterized by dryness, eczema, and scleroderma, and may be relieved by thyroid. Here the results probably are due to increased skin growth with increased skin moisture resulting from an increased metabolism.

3. *Heart block.*—Thyroid medication may prevent Adams-Stokes syndrome or heart block.

4. *Sterility.*—Certain sterile or habitually aborting women may become fertile or go through a normal pregnancy if placed on small doses of thyroid.

5. *Pregnancy.*—Pregnant women with goiters and a low basal metabolic rate should receive thyroid medication for the dual purpose of maintaining and continuing the pregnancy and protecting the infant.

6. *Menopause.*—Due to the hypoactivity of most of the endocrine glands at the menopause the use of thyroid substitution therapy at this time frequently gives good results in controlling the fatigability, irritability, and obesity, especially when given in conjunction with theelin.

7. *Obesity.*—Thyroid hormones by their action in increasing the basal metabolic rate and producing hyperthyroidism have been used for several years to produce a loss of weight. While it is a risky treatment, it is probably less harmful than the use of dinitrophenol.

8. *Diuresis.*—Thyroid extract does produce a diuresis by removing water from the tissues, particularly in the myxedematous patient. In other oedematous conditions, such as nephritis and heart failure, one can hardly expect results.

In using the dried thyroid gland as a drug, in addition to its effects on other endocrine organs, such as the female gonads, the physician

should have knowledge of its calorogenic and diaphoretic action, its direct action on the heart, its possible action as a diuretic, and its action as a stimulant to the regulative nervous system. The latter action by its effect on the bowel brings about an increased peristalsis and frequently a relief of constipation and its attending symptoms. Also, it seems that regeneration and healing of tissues, especially bone, is dependent upon thyroid stimulation.

PARATHYROID THERAPY

The clinical use of this hormone is dependent on its marked influence on the metabolism of calcium and phosphorus. Its physiological effects are: (1) To raise the blood calcium and lower the blood phosphorus level, (2) possibly to increase the ionized calcium in the blood, (3) to increase the calcium and phosphorus excretion in the urine and, (4) to obtain the calcium necessary for the body needs either from ingested calcium or from that stored in the bones.

Following an intramuscular injection of the parathyroid hormone it is not uncommon for the patient to experience a sensation of warmth and tingling of the skin and a dryness of the upper respiratory passages. However, if the dose is excessive there is vomiting, anorexia, dulling of the mentality and drowsiness approaching coma associated with general atony, failing circulation and hypercalcemia (above 12 milligram percent). This condition must be treated by giving intravenous saline, the administration of magnesium and the discontinuance of hormone injections until the blood calcium level is down. Repeated small injections resulting in an excess of the hormone produces an elevation of the blood calcium with toxic manifestations. These are related primarily to the kidney and the osseous system. In the kidney as a result of the hypercalcemia there is a kidney damage resulting in a rise in the blood phosphorus and a retention of the nitrogenous waste products. Kidney stones and *ostitis fibrosa cystica* may develop.

Thus, when treatment with parathyroid extract is being carried out it is essential that its effect be closely checked by blood calcium estimations in order to avoid undesirable consequences. A blood calcium above 12 milligrams per 100 cubic centimeters is never desirable. The effects of parathyroid therapy, intravenously, usually are apparent after a latent period of 4 hours and disappear after about 20 hours. This wave differs from that seen following administration of calcium salts intravenously, where the effect is immediate and lasts about 2 hours, and of large doses of vitamin D, where the calcium level in the blood gradually rises over a period of days and is maintained for 2 weeks or more.

Further, vitamin D, in addition to raising the blood calcium level, also increases the absorption of calcium from the intestinal tract, a property which parathyroid therapy does not have. Since vitamin D can be given by mouth, it often is preferable as a substitution for parathyroid extract administration, especially where prolonged treatment is indicated. But in an emergency the extract must be given, the effects of which are established in a few hours as compared to days for the vitamin therapy. Another disadvantage of vitamin D therapy is that overdosage causes hypercalcemia which lasts for 2 weeks or longer, and other undesirable signs, such as nausea, lack of appetite, loss of weight, may occur. Fortunately the amount of vitamin therapy necessary to produce these untoward effects is well above that now prescribed, but with the fortified preparations being put on the market this possibility must be borne in mind.

The primary use of parathyroid extract is in the treatment of tetany due to low blood calcium. In the treatment of tetany, due to alkalosis, it is not indicated. In other conditions where a rise in the blood calcium theoretically would be of clinical value, such as in the healing of fractures, in pregnancy and lactation, in edema of heart or kidney origin that fails to respond to other forms of therapy, in the control of dental caries, in asthma, and in hemorrhage, the value of parathyroid therapy has either not been established or has been found to have no advantage over a high calcium intake correlated with vitamin-D therapy.

The chief disadvantages of parathyroid therapy are that extracts now available gradually deteriorate and that continuous treatment produces in the patient a state of immunity. Hence, the use of parathyroid therapy is restricted to those rather acute conditions where treatment will be for a few weeks rather than for many months.

Dosage.—The dose is, of course, regulated according to the urgency of the occasion and the calcium level of the blood. Repeated small doses have been found to be more effective than a single large injection. The average daily dose is from 50 to 100 or more units. If the treatment is to be prolonged, tolerance will become established and vitamin D, of a necessity, must be given. (As has been said before, 100 units of parathormone is that amount which will increase the calcium content of a dog's blood 1 milligram per 100 cubic centimeters.)

THERAPEUTIC APPLICATION OF INSULIN

The old axiom that fat is burned in the flame of carbohydrate is just as true today as it was the day it was first expressed. From this it is apparent that every individual from birth until death needs insulin to live. As with the other glands of internal secretion,

we can have only two dysfunctions of that portion of the pancreas supplying insulin—hypo- and hyper-activity. With hypofunction we have too little of the hormone insulin which, in turn, allows a hyperglycemia and glycosuria to develop which is designated as the disease entity, diabetes mellitus. With hyperactivity we have too much of the hormone insulin with resulting low blood sugar and its attending symptoms of hyperinsulinism.

As stated previously, the exact mechanism by which the islands of Langerhans are stimulated to the production of the necessary quantity of insulin is not known. There are three possible theories: First, that it is the carbohydrate level of the blood which regulates the supply; second, that it is an interrelated play of hormones which stimulate the islands to supply insulin; and third, that it is of a nervous mechanism. Whatever the mechanism, the seeming characteristic call upon the islands for insulin is delicately balanced with the manufacture and release of this hormone and is certainly adjusted to the need for utilization of carbohydrates according to the varying demands at exercise and rest.

Many investigators have shown that a diet high in fat and low in carbohydrate decreases the supply of insulin to the body. At the present time many writers are expressing the thought that the efficiency of the insulin supply may be altered in some way by dysfunction of the pituitary, the thyroid, and the adrenals and in this way diabetes mellitus may result. In hunger and fatigue, we have an altered disposition of the patient to the irritability side which may be due to too much insulin with its resulting hypoglycemia. However, it is most difficult to decide whether the low carbohydrate level of the blood in these conditions is due to too much insulin or to a utilization of the carbohydrate of the blood, which results in a glycogen deficiency and attending fatigue and irritability.

From what has been said it can readily be seen that at the present time we do not know just what the toxic agent, if any, is that harms the islands of Langerhans in diabetes mellitus. We do know that it is only in most rare instances that there is complete loss of function of the pancreas to produce insulin. Clinical experiments confirm, and physiological experiments seem to prove, that diabetes is not complete, in the sense that insulin is completely absent from the body. This very fact complicates insulin therapy to a marked degree, because we cannot determine the quantity of insulin that the remnant of the gland may produce; and not knowing this, we do not know how much to supply except by the trial and error method.

Furthermore, the normal production of insulin is variable. Therefore therapeutic results must be interpreted with caution. As Dr. Joslin has so aptly stated many times, "There is no need of the

diabetic to die of diabetes today." And paradoxical as it sounds, the statement is true that the proper dietary and insulin treatment of a patient may enable the diabetic ultimately to do without the insulin substitution therapy. Insulin must be definitely correlated with the diet, in that if the diet is extreme in any direction the pancreatic islets deteriorate.

The action of insulin.—Insulin lowers the percentage of sugar in the blood and favors its storage and utilization in the liver, but its action on muscle glycogen, if it acts on muscle glycogen at all, is obscure. As a result of this, metabolism is maintained at a fairly normal level and there is conservation in the use of calories, and ketosis is prevented. If too large a dose of insulin is given, the blood sugar level is lowered below the normal to such a degree that the whole series of symptoms known as "insulin shock" arise. When the blood sugar drops the regulatory mechanism of the body, through the sympathetic nervous system, tends to relieve the hypoglycemia by calling upon the liver glycogen reserve. If this demand continues the whole store of the body glycogen may eventually be used up, and acidosis follows. When the liver glycogen reserve is lost, the liver stores fat and is harmed and is thus unable to act in its full capacity of furthering carbohydrate metabolism even under glucose and insulin therapy. This state of carbohydrate and glycogen depletion should be prevented by the administration of carbohydrates; and if this is done in time, that is to say, when the blood sugar is low or falling, glucose is well tolerated and the patient soon recovers the normal metabolic balance with a definite sense of well-being. Insulin is susceptible to many influences. If the supply of insulin is sufficiently curtailed or if there is an impairment of insulin efficiency by an overactivity of the pituitary, the thyroid, the adrenals, or any combination of these, the clinical entity, diabetes mellitus, results.

Efficiency of insulin.—Normally insulin is present in the human blood stream at all times. Therefore, in treatment, to attain the highest efficiency it should be given continuously. Unfortunately, this is not possible, but, fortunately, we are rarely confronted with a total diabetic. Thus we need not attempt to imitate nature, which regulates the supply of insulin according to the carbohydrate demand of every minute, of every hour, of every day. Experimentally it has been calculated that a normal individual of 60 kilograms weight requires approximately 8 units of insulin per day when fasting, 48 units per day when on an exclusive carbohydrate diet, and about 60 units when at hard physical exercise.

There is no doubt that repeated hourly injections of insulin have far greater therapeutic value than two to three doses per day, but

the disadvantages of the multiple dose method far outweigh the advantages gained over the interrupted dose method. One must understand, however, that the more severe the disease the more often insulin must be given. It may be accepted that the dose of insulin exerts an effect possibly for a period of 8 hours, and for the great majority of diabetics one or two doses of insulin per day will suffice. As has been said before, to attain maximum efficiency in the use of insulin continuous administration would be necessary. It has been repeatedly demonstrated that the more frequently insulin is given the more efficient its action and the smaller the total dose necessary to produce the desired results. However, from a clinical standpoint we know that frequently a single dose of insulin per day suffices for many diabetic patients. Probably more than one-half of diabetics receiving treatment today receive only one dose of insulin daily. The clinician must constantly keep in mind that the more severe the diabetes, or in the presence of infection, the more frequently insulin should be administered. As a general rule in coma, which is an emergency, and in which the need is extreme and the demand for rapid action the greatest, it is often given every 30 minutes.

When one dose of insulin per day suffices, it is best to give it before breakfast; if two doses suffice, give one before breakfast and one before the evening meal. If the unit dosage reaches the level of 20 to 40 units at each injection, three or more doses per day may be advisable. It is the practice in diabetes to give the smaller unit dosage in the evening to prevent the production of hypoglycemia during sleep. The average daily dose of insulin taken by insulin-treated diabetics is probably about 30 units. Because the quantity of carbohydrate in the diabetic diet is constantly being increased in the United States today, of a necessity the unit dosage of insulin is increasing.

No one today can answer the question as to how many grams of carbohydrate one unit of insulin will metabolize in the body. There are too many factors involved: for instance, exercise, improvement in the patient's own condition, insulin resistance, ketosis, glycogen reserve, etc. These factors never remain constant. In ketosis several units may be necessary to utilize 1 gram of carbohydrate; but as the patient improves, less and less insulin is required to bring about the utilization of 1 gram of carbohydrate. Thus in bronze diabetes (hemochromatosis) we have impaired glycogen storage facilities, and insulin fails to find any glycogen upon which it can act. Insulin here cannot be blamed, and this is only one of the many states where insulin is not at fault. It is dangerous to prescribe insulin by any arbitrary rule. It has often been stated

that in general 1 unit of insulin will metabolize from 1 to 2 grams of carbohydrate, but some authorities raise this ratio from 3 to 7 grams. However, it is impossible to say definitely what the exact amount is because of the uncalculable factor—the number of units of insulin that the patient's pancreas was putting out at that particular moment.

ADMINISTRATION OF INSULIN

Method of administration.—All methods of administration, except by the use of the needle, have proved ineffective. It is recognized as a general rule today that any drug, the effects of which may be induced by oral administration, should be given by mouth. The second method of choice should be subcutaneously, and the third method intravenously. Applying this statement to insulin, the oral route at present is ineffective. The subcutaneous route is the method of choice, the intravenous method being reserved only for cases of grave emergency. It must be remembered that insulin injected into the skin at times gives rise to an insulin burn or blister, and it is therefore important that the drug be deposited in the subcutaneous tissues. As to the site of the injection, no more than one dose should be given at the same site during the period of a month. For convenience it is best to go from one side of the body to the other, choosing points on the upper and lower extremities, buttocks, back, and abdominal wall.

Time of injection of insulin.—The maximum effect of an injection of insulin occurs in about 60 minutes, but the action of insulin may last 8 hours. Absorption from the digestive tract is irregular and may not occur for 3 or 4 hours. The highest blood sugar level obtained is usually following the morning meal. None of these statements can be taken as absolute, as many variations occur. Therefore a definite study of the patient must be made and much latitude given. From what has been said, as a general rule it is best to give insulin 30 minutes before meals and the largest dose before breakfast.

Insulin dosage.—The danger in measuring the dose is real in view of the fact that we have what is called U-10, U-20, U-40, and U-100, where 1 cubic centimeter contains 10, 20, 40, and 100 units, respectively. Most clinicians today use the 40-unit strength, thus reducing the volume of fluid required at each injection given. Every diabetic should be cautioned to read the label before injection to insure the proper dose.

Insulin prescriptions.—Patients should be taught the usual insulin prescription, which is generally written as 10-0-0 or 15-10-5 and which means the amount to be taken before each meal, the first

figure representing breakfast, the second the noon meal, and the third the evening meal. Such prescriptions are written for stabilized diabetics only. Before such stabilization, or in the presence of infection, and at times even in stabilized diabetics, the sugar reaction in the urine controls the insulin dosage. Joslin has evolved a formula for the insulin dosage under such conditions when the urine for 3 to 4 hours after the meal is pooled and tested. The formula is as follows:

$$\frac{R-Y-G-B}{15-10-5-0}$$

in which the *R* indicates a red reaction to Benedict's solution, the *Y* a yellow, the *G* a green, and the *B* negative, while 15-10-5-0 indicates the units of insulin to be taken, the time interval to be established by the immediate needs. The range of dosage may again be altered with the height of the blood sugar, and the time interval is altered in accordance with the severity of the disease. In coma there is no definite dosage of insulin, some cases requiring only 50 units, while others may require as much as a 1,000 units in a 24-hour period. The condition of the patient, the degree of acidosis (ketosis), the height of the blood sugar, and the amount of sugar and ketone bodies excreted in the urine must all be taken into consideration.

COMPLICATIONS FOLLOWING THE USE OF INSULIN

Localized anaphylactic phenomena.—Localized anaphylactic phenomena frequently develop when insulin is first given to a patient, but in no case has it been necessary to discontinue insulin treatment of a diabetic because of this anaphylactic phenomena.

Insulin atrophies.—These are disfiguring, fairly permanent, and annoying. There is atrophy of the limbs which at times is deforming, and atrophic areas remote from the point of injection may occur. The cause is not known. The treatment is to prevent it by not giving repeated doses of insulin at the same site and searching at each visit for an insulin lump. Once established there is no definite treatment for these atrophies.

Insulin lump.—Tumefaction results if injections are long continued in one area. It is in such areas of tumefaction that needle-tract infections are prone to occur. Such areas are insensible to pain, and for this reason patients often prefer this site for further medication. It is obvious that insulin is poorly absorbed, if at all, from such an area.

DIET IN CONNECTION WITH INSULIN

According to Joslin's teachings, diets, extremely low in carbohydrate and high in fat, literally drive the diabetic patient into coma

and death. Those fortunate enough to avoid immediate death later die from acquired arteriosclerosis, atheromatosis, gangrene, and disturbed lipoid metabolism. Even in the fat diabetic a rapid reduction in weight may produce a high endogenous fat diet which results in acidosis and the lowering of the efficiency of insulin treatment. Further, when the diet is regulated as to quality and quantity, absorption may be delayed or the meal remain undigested in the alimentary tract for long periods of time. Thus, insulin treatment must be governed according to time and amount of the meal and general habits of the patient. From this it can be seen that a fatty acid-glucose ratio of 3:1 or even 1.5:1 is dangerous and that it is far better to have the fatty acid-glucose ratio 1:1.2 or even 1:1.5.

INSULIN REACTIONS

Practically the only reaction from insulin in an overdosage is hypoglycemia and hyperinsulinism. The symptoms of this condition are those due to the hypoglycemia. They are: A rapid onset, with a sense of hunger; tremor of the hands; dilated pupils, diplopia, firm eyeball; pale, moist skin, with sweating about the forehead; rapid pulse; normal respiration; normal blood pressure; absence of sugar in the urine; and a blood sugar below normal. These patients are apathetic, irritable, weak, and faint.

In the severe types of insulin reaction the above enumerated symptoms, if allowed to go unchecked, continue on to coma, followed by convulsions, and may end fatally from the extreme hypoglycemia. This condition is the exact opposite of diabetic coma, with its slow onset, turbid respiration, florid, dry skin, soft eyeball, dimness of vision, restlessness, nausea or vomiting, abdominal pain, hyperglycemia, and glycosuria.

Treatment of insulin reactions.—In the mild type 5 to 10 grams of dextrose by mouth will usually relieve the symptoms within a few minutes. However, at times two or three times this quantity is required. In the more severe type of reaction glucose must be given in larger amounts and the dose frequently repeated. It may even have to be given intravenously. In those cases which have become unconscious, glucose intravenously must be given. The longer the patient has been unconscious and the deeper the coma the more sugar the patient demands. Other methods of introducing glucose, as by nasal catheters, may be resorted to in the absence of intravenous equipment. By this method sugars other than glucose, such as sirup or honey, may be used when diluted with water.

As stated before, epinephrine will mobilize glucose in the blood stream provided glycogen is available and 1 cubic centimeter of a

1:1000 solution, hypodermically, may be used as an emergency treatment in an adult and half this amount in the child. Of course, glucose therapy must be instituted as soon as possible following such treatment.

INSULIN AND EXERCISE

Exercise lowers the blood sugar in the normal as well as in the diabetic patient. Muscular activity improves food tolerance and allows of a higher diet with a smaller dose of insulin. The effect of exercise is at times so striking and so beneficial that the diabetic today is taught diet, insulin, and exercise in the everyday treatment of his disease. Diabetics therefore should not be kept in bed but must be encouraged to take regular daily exercise. The influence of exercise on the utilization of sugar and the lowering of blood sugar by exercise must be borne in mind whenever insulin is prescribed. Intelligent diabetic treatment carries with it definite need for exercise. Generally speaking the dose of insulin is smaller when the patient is out of the hospital than when he is in and it is a good general rule to reduce the allowance of insulin when the patient is discharged. Adequate exercise may increase the tolerance for carbohydrate so rapidly that needless reactions may be produced unless the dose is reduced. Those clinicians who prescribe an adequate maintenance diet to cover the muscular activity of their patients and prescribe insulin freely are naturally the ones who are most frequently required to reduce or omit insulin.

MISCELLANEOUS CONDITIONS

Insulin and infections.—Patients should be taught how to take advantage of the fact that insulin is their insurance during an infection. Patients who have been in diabetic coma should be searched carefully for the coincidence of pulmonary tuberculosis and if not found watched closely for the next 3 years for its development. This is not an uncommon occurrence.

Glandular disturbances and insulin resistance.—Overfunction of the pituitary, thyroid, or adrenal glands tends to counteract the effect of insulin and hyperfunction of these glands along with infections, diseases of the liver, renal glycosuria, and arteriosclerosis must be sought for when the subject of insulin resistance arises.

Hyperinsulinism.—This condition has also been called "hunger disease" and "spontaneous hypoglycemia." It is an important condition for the surgeon and the internist alike as it is often accompanied by cardiac, abdominal, nervous, and mental symptoms. The usual onset is with hunger tremor, sweating, nervousness, fainting, convulsions, and unconsciousness. It must be remembered that hepatic dis-

eases, diseases of the adrenal, pituitary, and thyroid may produce marked hypoglycemia. Epileptiform seizures occur when the blood sugar reaches 40 milligrams percent. Hyperplastic islets, adenomas and carcinomas of the islets are known to produce large amounts of insulin even in the metastatic growths. The immediate treatment for this condition is the same as that given for insulin reaction. Following recovery a definite search and study should be made to determine the cause.

Renal glycosuria.—This condition is usually termed “renal diabetes” and is characterized by the constant presence of glycosuria regardless of the height of the blood sugar level. The pathology is in the kidney, this organ having no power to reabsorb sugar. Insulin therapy is not indicated in this disease and should not be used.

INSULIN AS AN ADJUNCT IN NONDIABETIC CONDITIONS

Thin, undernourished individuals.—This type of person may be caused to gain weight on a high caloric diet plus small doses of insulin before each meal.

Tuberculosis.—As an adjunct in the treatment of tuberculosis, insulin seems to improve the strength and spirits of these patients and also causes a marked gain in weight when combined with a high caloric diet. Insulin is in no way to replace the regular treatment of tuberculosis.

PROTAMINE ZINC INSULIN

What has been written in regard to insulin has been based on an active, aqueous solution of the antidiabetic principle of the pancreas, in use since 1922.

Protamine insulin is an aqueous solution of insulin to which has been added protamine. Protamine zinc insulin is protamine insulin and zinc. These latter preparations have been developed as a result of the work of Dr. Hagedorn and his associates. Protamine zinc insulin maintains the blood sugar at a lower level for a much longer period of time than unmodified insulin. Taking for granted that one unit of unmodified insulin will utilize 4 grams of dextrose, protamine zinc insulin seems to enable the body to utilize 20 percent more dextrose per unit than the unmodified insulin.

Evidence indicates that when a patient receives protamine zinc insulin there is a tendency toward a cumulative effect. To prevent the cumulative effect and resulting hypoglycemia in patients whose urine is sugar free, it will be necessary to reduce the 24-hour dose by 3 to 5 units per day, keeping the urine sugar free until the optimum dosage has been determined by frequent blood sugar determinations. When

a reaction of hypoglycemia occurs under protamine zinc insulin, it is of longer duration than that encountered with unmodified insulin. This is due to the prolonged effect of protamine zinc insulin. In patients who are prone to have hypoglycemia, it is better to distribute their caloric intake over four or five meals per day rather than three peak meals. Protamine zinc insulin should be given subcutaneously to insure the formation of a deposit of protamine zinc insulin in the tissues where it will be slowly dissolved and carried to the circulation. The maximal effect of protamine zinc insulin is reached from 12 to 24 hours after its administration, and the duration of its action is three to six times that of unmodified insulin.

The physician must understand that a period of several days may elapse before the full effect of protamine zinc insulin may be obtained. The Danish method is to substitute the evening injection of regular insulin with a dose of protamine zinc insulin, while in America the physician has practically adopted the method of giving the protamine zinc insulin before breakfast. When shifting from unmodified insulin to protamine zinc insulin, or when beginning treatment with protamine zinc insulin, frequent blood sugar determinations and urine examinations are necessary, and somewhat closer observation than was given under the unmodified insulin treatment must be maintained. Owing to the slowness with which protamine zinc insulin lowers the blood sugar, there may be produced a hypoglycemia without apparent discomfort. However, such reactions can be avoided. The occurrence of fatigue, headache, tingling sensation in the extremities, as well as weakness, nervousness, and sweating, leads one to suspect hypoglycemia and this should be immediately checked by laboratory examinations. This hypoglycemia must be immediately treated by feeding any available form of carbohydrate. If the patient is unable to swallow, the hypoglycemia must be counteracted by intravenous dextrose.

When a patient has been stabilized on protamine zinc insulin and maintenance diet, a reapportionment of the carbohydrates given will of course be necessary. The advantage of protamine zinc insulin is the smaller number of injections per day, the slowness of its action, the elimination of nocturnal hyperglycemia and glycosuria, and the privilege of allowing a diabetic to partake of one or two additional meals per day, on the same 24-hour caloric value. Diabetic coma should not be treated with protamine zinc insulin, as its action is too slow, and the present method of treatment with regular insulin should be continued. If one is using protamine zinc insulin together with regular insulin, they should be given neither in the same site nor in close proximity to each other. They should not be mixed together or given with the same syringe.

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THE TREATMENT OF MALARIA WITH ATABRINE FOLLOWED BY PLASMOCHIN

By CLAUDE R. BALL, Lieutenant, Medical Corps, United States Navy

In 1936 all cases of malaria which developed at the fleet air base at Coco Solo, in the Canal Zone, were treated with atabrine followed by plasmochin. The results were compared with those of the previous year (1935) when quinine sulphate was used. All cases studied during the 2-year period were confined to the fleet air base dispensary or at home under the care of a trained nurse. Twenty-one cases of benign tertian, nine of malignant tertian, and one of mixed benign tertian and malignant tertian malaria were treated with atabrine followed by plasmochin.

The treatment used in 1936 was outlined as follows:

- (1) Bed patient with head privileges.
- (2) Temperature, pulse, and respirations every 4 hours.
- (3) Regular diet.
- (4) Atabrine (2-methoxy-6 chlor-9 diethyl-amino-8 pentylamino acridine) 0.2 gram in a capsule at 8 a. m., noon, 8 p. m., for 4 days, making a total of 0.24 grams for the course.
- (5) Following the completed course of atabrine and beginning on the fifth day of treatment, plasmochin (n-diethylamino isopentyl-8 amino-6 methoxy-quinoline) 0.02 gram in a capsule was given three times a day after meals for 4 days, making a total of 2.4 grams for the course. This is the maximum dosage and may be given in smaller daily doses of 0.01 gram three times a day.
- (6) Patient to remain in bed absolutely quiet during the course in plasmochin.
- (7) Patient to be kept in bed for as many days without fever as he had with fever.
- (8) Daily low enema if patient fails to have a normal bowel movement.
- (9) If the patient vomits and expels the drug, repeat the dose until he retains it.
- (10) Three negative blood smears for parasites to be obtained after temperature has returned to normal, and before discharge.
- (11) Follow up examinations, each week for a month and each month for 6 months.

Table I is a summary of the symptoms attributed to the drugs used in the treatment.

TABLE I

Case no.	Type of malaria	Abdominal pain	Pigmentation of skin
5.....	B. T.....	Yes.....	No.
10.....	B. T.....	No.....	Yes.
26.....	M. T.....	Yes.....	Yes.
31.....	M. and B. T.....	Yes.....	No.

Table II lists the number of cases and type of malaria during the months when malaria occurred.

TABLE II

	May	June	July	August
Benign tertian.....	5	10	3	3
Malignant tertian.....		5	3	1
Mixed.....		1		

Table III lists the average number of days with fever after the beginning of treatment and the average number of sick days per patient.

TABLE III

Case no.	Average days of temperature	Average number of sick days
1 to 31.....	4.0	12.96

In 1935, 29 cases of benign tertian and 1 of malignant tertian were treated with quinine sulphate. The treatment as outlined was as follows:

- (1) Bed patient with head privileges.
- (2) Temperature, pulse, and respirations every 4 hours.
- (3) Quinine sulphate grains X at 8 a. m., noon, 8 p. m. for 4 days.
- (4) Beginning on the fifth day, quinine sulphate grains X was given daily for a period of 12 weeks.
- (5) Hospital corpsman to personally see that patient swallows the dose of quinine sulphate given.
- (6) If patient vomits up the medicine, repeat until it is retained.
- (7) Patient to remain in bed as many days without fever as he had with fever.
- (8) At least three negative smears for parasites must be obtained after the temperature has returned to normal and before the patient can be returned to duty.
- (9) Follow-up treatment: Blood smear each week for a month and each month for 6 months.
- (10) Patient requested to avoid the use of alcohol in every form while taking quinine sulphate medications.

Table IV is a summary of the symptoms attributed to quinine used in the treatment.

TABLE IV

Case no.	Type of malaria	Ring in ears	Urticaria and itching
3.....	B. T.....	No.....	Yes.
10.....	B. T.....	Yes.....	No.

Table V lists the number of cases and type of malaria during the months they occurred.

TABLE V

	May	June	July	August	Sep- tember	Octo- ber	No- vember	De- cember
Benign tertian.....	1	13	7	-----	1	5	-----	2
Malignant tertian.....	-----	1	-----	-----	-----	-----	-----	-----

Table VI lists the average number of days with fever after beginning of treatment and the average number of sick days per patient.

TABLE VI

Case no.	Average days of temperature	Average num- ber of sick days
1 to 30.....	3.6	9.76

RESULTS

A comparison of the results obtained in this small number of cases was found interesting. The study was made in order to obtain personal experience with the use of atabrine and plasmochin, relatively new drugs, now being used in the treatment of malaria. One notes that the total number of cases occurring in 1935 is practically the same as that for 1936. By far the largest number of cases occurred in the month of June during both years. Nine cases of malignant malaria were treated in 1936 and but one in 1935. The average number of days of temperature after the diagnosis has been made and treatment started is nearly the same, being 4 days in the 1936 cases, when atabrine and plasmochin were used and 3.6 days when quinine sulphate was used. The average number of sick days per case was found to be 12.96 in 1936, as compared to 9.76 in 1935. Reactions attributed to the drugs used in the treatment, while not alarming or severe in either group, occurred in four cases in the 1936 series, as compared with two cases in the 1935 series, when quinine was used.

Table VII is a summary of the cases known to have been readmitted for treatment after having been discharged as apparently cured, insofar as we were able to determine, as checked by the subjective and objective symptoms, blood smear, and blood count.

The following table gives a comparison of the relapse rate of the cases treated.

TABLE VII

Case no.	Type	Therapy	Time elapsing before recurrence	Previous history of malaria
22 (1936).....	M. T.....	Atabrine and plasmochin.....	1 month.....	No.
23 (1936).....	M. T.....	do.....	26 days.....	Yes.
2 (1935).....	B. T.....	Quinine.....	12 months.....	No.
10 (1935).....	B. T.....	do.....	2 months.....	Yes.
11 (1935).....	B. T.....	do.....	6 weeks.....	No.
16 (1935).....	B. T.....	do.....	5 weeks.....	Yes.
18 (1935).....	B. T.....	do.....	3 months.....	No.
22 (1935).....	B. T.....	do.....	4 months.....	No.
25 (1935).....	B. T.....	do.....	3 months.....	No.
27 (1935).....	B. T.....	do.....	1 month.....	No.
29 (1935).....	B. T.....	do.....	11 months.....	No.

The cases treated with atabrine and plasmochin have been followed for 4 months and the cases treated with quinine over a year. All cases readmitted during the 2 years were given atabrine followed by plasmochin. The percentage of relapses under the treatment of atabrine and plasmochin as compared with that of quinine for a given period of 4 months is 6.45 in the former and 23.33 in the latter. Cases 22 and 30 were readmitted within the first month following their treatment with atabrine and plasmochin. The subjective and objective symptoms were the same as on their previous admissions and the blood smears were found to be positive. A routine blood smear had been made in both cases a week before admission and parasites had not been observed. Case 30 had malaria previously and had been treated with quinine a year ago (1934). Case 22 was a primary case, in a mess cook who was sleeping in quarters with other mess cooks, several of whom had developed malaria previously and several infections followed his. The other 29 cases remained apparently cured at the end of 4 months.

In the cases treated with quinine, seven were readmitted for treatment within 4 months and two later, making a total of nine cases within the year. Cases numbers 2, 10, 11, 18, 22, 27, and 29 had typical subjective and objective symptoms but case 16 had no symptoms; he was found to have parasites in his blood during the routine blood examination which was done on all cases after discharge.

One in the tropics is usually unable to determine whether or not a given case with a previous history of malaria should be placed in the group of relapses or primary cases. There are those who doubt if a given case of malaria is ever cured and others who just as firmly believe that a case without subjective or objective symptoms, a negative blood smear, normal white blood count, and differential is cured.

When a case of tuberculosis is diagnosed certainly every effort is made to locate the source; especially is this true when the patient is a child. The parents, brothers, sisters, and close friends are examined. With the idea in mind that an individual is more or less lim-

ited to a certain area in his daily routine, and that the infected mosquito is likewise apt to stay in the same neighborhood during its lifetime of probably not over 3 months, a careful check was made to determine the source of infection in these cases. The quarters were carefully checked for mosquitoes and the screening noted. The crew on the same ship were examined. When a patient was returned to duty he was told of the danger of his spreading malaria to his shipmates and family unless he continued to report for examination until discharged as cured.

The positive sources, briefly described, were as follows: The largest percentage of our primary cases as well as the re-admissions came from two small ships which practically always tied up to the dock in the same area. This area was always well lighted and a number of the crew usually slept openly on the deck. All admissions gave a history of having been bitten numerous times before being admitted. Two cases without symptoms were found on examination of the crews of these ships. This particular area of the station has always contributed more than the rest of the station. The mess attendants' quarters on the station were found poorly screened. Some of the mess attendants had made a short trip on the two small ships mentioned above. One mess attendant was found to have parasites but no symptoms. The home of one enlisted man was examined after his wife developed a case of malignant malaria. Mosquitoes were found on the walls and in numerous flower pots. A nurse, taking care of a small child, had been away from the station and staying at a hotel along the shore. She took short walks in the evening after the child was in bed. A week later after returning to the base she developed malignant tertian malaria.

From a review of the recent literature on the treatment of malaria, one can roughly summarize the efficiency of the synthetic antimalarial drugs and quinine as shown on table VIII.

TABLE VIII

	Tertian		Malignant		Quartan	
	Gametes	Shizonts	Gametes	Shizonts	Gametes	Shizonts
Quinine.....	•	••	••	•	••
Atabrine.....	•	•	•••	•	••	••
Plasmochin.....						

••• = 100 percent results, the drug not yet discovered.

ATABRINE

Atabrine is apparently the best drug that we have at the present time to use in the treatment of malaria. Since it has little or no action on the gametes in malignant tertian malaria the combined

treatment of atabrine followed by plasmochin as outlined in the treatment used in Coco Solo in 1936, and previously reported in the literature is the one of choice. The treatment for primary and relapse cases of all cases of all types is practically alike.

The dose of atabrine may be calculated by giving 35 milligrams per kilogram of body weight. (The toxic dose is 200 milligrams per kilogram of body weight.) Persons weighing between 132 and 176 pounds can take the treatment as previously outlined. Adults weighing above 176 pounds, and children, should have the dosage calculated. The therapeutic dose recommended by the manufacturers is as follows:

Oral dose.—

Adults.—One tablet of 0.1 gram ($1\frac{1}{2}$ grains) three times daily for 5 days, or twice daily for 8 days.

Children 1 to 4 years.—One tablet of 0.05 gram (three-fourths grain) twice daily for 5 days, or once daily for 8 days. The tablet may be crushed and suspended in honey, sirup, etc.

Children 4 to 8 years.—One tablet of 0.1 gram ($1\frac{1}{2}$ grains) twice daily for 5 days or once daily for 8 days.

Children over 8 years.—Same dose as for adults.

Intravenous doses.—It should not exceed the oral one, 0.1 gram (one-half ampule) and 0.05 gram (one-fourth ampule) for children up to 8 years of age. Repeated two or three times daily but may be given at shorter intervals in cases of coma. Oral administration to be given as soon as possible.

Intramuscular dose.—Same as the oral dosage but in urgent cases up to 0.2 or 0.3 gram for adults. For intramuscular use the atabrine powder contained in one ampule (0.2 gram) should be dissolved in 7 cubic centimeters of distilled water.

The test for the elimination of atabrine consists of alkalizing 10 cubic centimeters of urine by addition of potassium carbonate. Amyl alcohol (2 cubic centimeters) is added and shaken with the alkaline fluid, and the presence of atabrine is recognized by the green fluorescence of the alcoholic extract held against a black background.

Atabrine when taken by mouth is rapidly absorbed and slowly eliminated. For that reason when a course of atabrine has been finished it should not be repeated within 6 weeks or at least without determining the presence or absence of the drug in the blood. It is an accumulative drug.

There are those who recommend giving the atabrine in one large dosage daily of 0.06 gram in capsules daily after breakfast for 4 days, believing that a concentration of 1–200,000 is the therapeutic concentration and is quickly achieved by the large single dose given daily.

Prophylactic dose for adults is given one tablet of 0.05 gram (three-fourths grain) once daily, or one tablet of 0.1 gram (1½ grains) every other day throughout the malarial seasons. Children, one tablet of 0.5 gram (three-fourths grain) every other day.

TOXICITY OF ATABRINE

A review of the literature leaves one with the feeling that atabrine is a safe drug to use in the treatment of malaria. A yellowish discoloration of the skin and conjunctiva is not uncommon, the discoloration beginning about the third day after treatment and usually disappearing in 2 weeks after completion of the treatment but may linger for 2 months. The discoloration is not due to liver damage and there is an absence of bile in the blood stream. A certain number of symptoms, abdominal pain, nausea and vomiting, headache, diarrhea, etc., have been attributed to atabrine but could also be attributed to the malaria. Mental symptoms attributed to the drug have also been reported while other cases of a definite psychosis have been reported as improving after developing malaria and receiving treatment with atabrine. A fatal case of atabrine poisoning following injection of atabrine mussonate was reported by P. B. Fernando and E. M. Wijeroma (Colombo, Ceylon) *Lancet* 2:1056, November 9, 1935.

PLASMOCHIN

The therapeutic dose of plasmochin recommended by the manufacturers is as follows:

Adults.—One tablet 0.01 gram (one-sixth grain) three times daily for 5 days, or twice daily for 8 days.

Children 1 to 4 years.—One table 0.01 gram (one-sixth grain) daily for 5 days, or 0.005 gram (one-twelfth grain) one-half tablet for 8 days.

Children 4 to 8 years.—One tablet 0.01 gram (one-sixth grain) twice daily for 5 days or once daily for 8 days.

Children over 8 years.—May be given the adult dose.

Prophylactic dose for adults is given as two tablets of plasmochin 0.01 gram (one-sixth grain) each, three times a week on alternate days. Children one-half to one tablet of 0.01 gram (one-sixth grain).

TOXICITY OF PLASMOCHIN

The objective symptom most prominent and attributed to plasmochin was a rather marked cyanosis. The mucous membranes, finger nails, and skin assume a grayish color. Some writers think this is due to the formation of methemoglobin while others fail to find any decrease in the total hemoglobin and no apparent decrease in the red blood cells after beginning the treatment. The cyanosis is not accom-

panied by the usual symptoms of dyspnea and increased pulse rate. The cyanosis disappears soon after completion of the treatment and is hastened by quinine medication. Cardiac arrhythmia and heart disease have been attributed to the drug. Epigastric pain, nausea and vomiting, headache, and clammy sweats have also been reported.

In this series of 31 cases, 3 cases had definite abdominal epigastric pain. All were of the nervous type, asthenic build, and with a definite lowering of the threshold of pain. The maximum dosage of plasmochin was given. No other subjective or objective symptoms were attributed to plasmochin. Two cases developed a yellowish discoloration of the skin and conjunctiva attributed to the atabrine. Three cases had definite cerebral symptoms of loss of memory for recent events and one was delirious. These symptoms were present before medication was started and in cases where the diagnosis of malaria had been made late. One hypertension case showed a marked improvement following her illness of malaria. The improvement was attributed to rest in bed. The most important single factor found was the necessity of the patient remaining absolutely flat on his back in bed during the course in the plasmochin administration. The patients who followed this advice were all free from abdominal pain.

There are those who advocate the withholding of medication until the patient has had numerous high temperatures, stating that they are allowing the patient to develop individual immunity. It is true that pernicious malaria usually occurs during the primary attack of malignant tertian malaria. Charles C. Bass, discussing the prognosis of malaria, states: "It can be stated confidently that practically no malaria patients die except those who do not receive proper treatment or those who are too far advanced before treatment is instituted." My own personal opinion is that it is impossible to determine which cases are likely to develop a case of pernicious malaria. It seems foolish for the doctor to withhold treatment until the spirit moves him to begin treatment. A short while ago all aviators and those attached to a plane were required to learn how to use a parachute by jumping from an airplane. When someone pointed out that this practice was not necessary as it had to be done right the first time it was discontinued.

SUMMARY

Thirty-one cases of malaria were treated with atabrine followed by plasmochin and the results compared with a similar number of cases treated the previous year with quinine medication. The results obtained in this small number of cases compares favorably with that of larger groups reported in the literature.

CONCLUSION

The combined treatment of atabrine followed by plasmochin is safe and the number of relapses less than that of a similar number treated with quinine.

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A CONSIDERATION OF THE MECHANISM AND TREATMENT OF SURGICAL SHOCK

By T. R. AUSTIN, Lieutenant (Junior Grade), Medical Corps, United States Navy

In the whole field of surgery, there is probably no subject upon which more has been written and upon which most of us remain as

poorly informed than surgical shock. I think the clinical picture of the shock syndrome is too familiar to us all to warrant a description. However, the terms primary shock and secondary shock should be differentiated. Primary shock, sometimes called "neurogenic shock", is a term used to designate the state of collapse associated with a drop of blood pressure, which occurs almost immediately after the receipt of an injury. A satisfactory explanation seems to have been made by Golz (1) in 1863 and by Phemister and Livingston (2). The primary alteration is a decline in blood pressure following a vasodilatation depending on diminished constrictor tone as a result of influences acting through the nervous system. This may be followed by a decrease in blood volume and cardiac output. This state may be brought about by psychic effect of fear or pain; by reflex means, as a sudden blow to the abdomen or operative trauma; or by agencies affecting the nervous system directly, such as spinal anaesthesia or trauma. Unless this condition is complicated by an element of secondary shock, it is improved by the administration of vasoconstrictor drugs. These reactions are ordinarily transient and of minor importance but may rarely be fatal or at times be prolonged into the condition of secondary shock. By the term "secondary shock" is meant the type that usually appears an hour or longer after receipt of the injury. However, Phemister (2) insists that "primary and secondary shock should be recognized on the basis of difference in etiology, rather than in difference in time of occurrence." It is this condition of secondary shock about which most controversy and study has centered.

James Latta in 1795 is generally given credit for first using the term "shock", with its present meaning. The condition has been described by Paré, Hunter, Cooper, and Travers. The latter, in his condemnation of the accepted practice of bloodletting, as early as 1870, manifested a concept of the subject far ahead of his time, in fact one much better than many expressed since. Billroth was among the first in Germany to interest himself in the subject. The Civil War offered Weir Mitchell, Morehouse, and Keen an opportunity to contribute data on the subject. The more recent outstanding contributors include Malcolm, Mann, Crile, Henderson, Cannon, Bayliss, Phemister, Parsons, Underhill, Blalock, and Heuer.

As to the explanation of the phenomenon of shock, Ravdin says "It is now more or less universally agreed that surgical shock is the result of a loss of blood volume." To properly evaluate the proof advanced for this conclusion we shall now review some of the other theories which have been at some time or other widely accepted as the explanation of his condition.

The explanation advanced by Crile (4) was that of exhaustion of vital nerve centers as a result of repeated painful stimuli. Following prolonged injuries to remote tissues, he was able to demonstrate definite morphological changes in the brain cells of experimental animals. Many objections were found to this theory. Janeway and Ewing failed to produce shock in animals after 2-hour stimulation in the presence of maintained blood pressure. Moreover, Forbes demonstrated brain-cell changes identical to those of Crile, produced by impairment of the cerebral circulation for a short time. This indicated that these changes were a result, rather than a cause, of shock. This exhaustion theory presupposed a state of vasodilatation, whereas Seelig (5) has demonstrated that a state of vasoconstriction exists in shock.

Another theory which enjoyed a wide following for some time was the acapnia theory of Yandell Henderson (6). His theory expressed the idea that afferent stimulation by trauma produced a prolonged hyperpnea, with the loss of carbon dioxide. A similar condition was found frequently to follow opening of the abdomen, with trauma or drying of the viscera. Furthermore, experimentally induced hyperventilation frequently resulted in the production of a shock-like state. Cannon and Bayliss (7) subsequently produced shock by traumatizing the extremities of an animal in which the respirations were controlled by artificial means. Roome (8), moreover, has demonstrated that in cases of shock produced by hemorrhage, less hemorrhage was necessary to produce death after marked pulmonary over-ventilation had been produced.

Cannon (9) has recently called attention to the "possible inhibition of vasoconstrictors and stimulation of vasodilators in acute circulatory collapse, and more certainly a prolonged activity of the sympatho-adrenal system when conditions are present that bring that system into operation." The supposition that any nervous agency acting in the production of shock must act quickly, failed to take into consideration certain conditions generally admitted to contribute to the production of shock. Thus pain, exposure, and emotional upsets are doubtless conducive to the development of a shock-like state. These, Cannon pointed out, certainly involve the nervous system, especially the sympatho-adrenal system. It had already been demonstrated by Erlanger and Gasser (10) that prolonged vasoconstriction would result in a decrease in blood volume. In 1925 Cannon and Britton (11) carried out an ingenious experiment, in which an animal was made to secrete adrenalin by an emotional stimulation, namely, rage. Under brief ether anaesthesia the cerebral cortex of a cat was swiftly destroyed and on recovering from the anaesthesia the animal manifested, to a supreme degree, the physiological

phenomena of rage. In this condition the blood volume decrease averaged 22 percent. There was not only a decrease in the fluid elements of the blood but in the corpuscular elements as well. These experiments were repeated after blocking the sympathetic nerve impulses by administration of ergotoxine, and again by complete surgical sympathectomy of the animals. In these cases there was no resultant diminution of blood volume. These findings would lead to the conclusion that sympatho-adrenal stimulation was responsible for the phenomenon. It is worthy of note that in some of these experiments (Freeman (12)) the carotid arteries were ligated before the brain was traumatized, thus isolating this tissue from the general circulation. This fact would certainly tend to render the explanation on the basis of local loss of fluid into the traumatized area unlikely. This fact, as well as the failure of the phenomenon to be induced in the completely sympathectomized animals, seems to eliminate the theory of toxemia as an explanation. The theory of adrenal hypoactivity has been fairly well discarded in view of the work of Mann (13), who noted that the typical picture of shock did not follow removal of the adrenals; and by Blalock and Johnson (14), who noted that adrenalectomy produced first a fall in blood pressure, then a diminution in cardiac output, whereas in typical shock the sequences of events was reversed.

Probably the theory which has enjoyed the widest popularity is the theory of toxemia. Dale and Richards, working on the British Medical Research Committee in 1917, demonstrated that injections of histamine would produce a shock-like state. It was known that histamine or histamine-like substances were to be found in injured tissues. Thus the importance of the production of shock by means of toxic absorption was brought into prominence, although Quenu (15), the French surgeon, had earlier supported this theory. The typical example cited was that of the soldier with the crushed leg, who arrived at the hospital with a tourniquet applied to the proximal part of the injured leg. He was, symptomatically, in good condition. On removal of the tourniquet, although no bleeding occurred from the crushed leg, the patient immediately passed into a profound state of shock. This case has been repeated, in principle, many times. The explanation by the champions of the toxic absorption theory was that removal of the tourniquet permitted the release of toxic substances from the injured extremity into the blood stream, with its subsequent absorption by the system and death from shock.

Probably the most significant experiments were those of Cannon and Bayliss (7), in which they produced shock in anaesthetized animals by crushing one of the posterior extremities with a hammer. It is to be noted that such a technique is a most excellent

one and has been used by many investigators in collecting data in support of their respective theories, since this produces alterations most closely simulating the clinical problem confronted in actual cases of shock. Furthermore, it leaves the opposite, nontraumatized extremity to be used as a control. In the dogs so treated, death followed after several hours. The amount of blood and lymph lost into the extremity was then determined by amputating both lower extremities by symmetrical cuts across the upper thighs and noting the difference in their weight. These experiments were repeated after section of the spinal cord in the upper lumbar region and the fact that the results were not altered argues against the influence of any nervous agencies. A repetition of the experiment, preceded by ligation of the vessels to the leg, resulted in no fall in blood pressure until the ligatures were removed. This they concluded, justified an explanation on the basis of toxic absorption. The fallacy of these conclusions will be seen as the experimental work of the champions of the "fluid loss" theory is recounted. Moreover, no "toxic substance" has ever been demonstrated in these experiments.

The theory which is probably the most adequate today is the theory of local fluid loss. Investigators working on this theory began at a time when the toxic theory was the one most universally accepted. For that reason their experiments had naturally a two-fold objective; to demonstrate that local fluid loss was adequate to produce typical shock, and to demonstrate that a toxic factor was not responsible. To this end, Parsons, Phemister, and Blalock (16) repeated Cannon's experiments in the belief that his amputations had not been sufficiently high to determine the entire loss of fluid. They performed similar experiments but amputated at a level sufficiently high to include the loose tissues of the groin and flank and demonstrated by weight difference of the amputated parts a sufficient loss of fluid to explain the shock state. This difference in weight averaged 3.66 percent of the body weight. The fluid which escaped into the injured tissue was found to have almost exactly the same composition as the blood plasma. It is important to note that the protein content of the two was the same because this is the constituent largely responsible for the maintenance of osmotic pressure in the vessels. Since this fluid resembled so closely blood plasma, experiments (17) were undertaken to determine the amount of plasma which must be lost to produce shock. This was carried out by slowly removing blood from a vessel, defibrinating and centrifuging it, and reintroducing the corpuscles into the animal. The results obtained demonstrated that the amount lost into the highly amputated extremity was sufficient, alone, to explain the condition of shock produced.

In 1923 (18) Underhill called attention to the importance of fluid loss in another type of injury, namely, burns. His findings do not

support the theory of toxic absorption. Other investigators (19) immediately set about to determine the exact amount of fluid lost in burns. By burning one side of a dog, subsequently bisecting the animal, and comparing the weight of the halves, they found a fluid loss into the burned tissue averaging 3.34 percent of body weight, easily enough to account for the shock on the basis of the amount found sufficient in the above mentioned experiments. Other experiments of surgical significance were carried out by gently passing the intestine of an animal of known weight through the fingers until an intraperitoneal weeping of fluid (which also had approximately the same composition as blood plasma) was induced and sponged away. Fluid lost in urine, feces, and expired air were accounted for and the difference in weight of the dog, before and after, was assumed to represent, roughly, the lost fluid. Again, this amount was found adequate to account for the degree of shock produced.

Evidence against the toxic theory was increased by experiments in which animals had their femoral arteries and veins isolated and clamped separately, then had that leg crushed. Removal of the clamp from the vein failed to produce shock but removal of the clamp from the artery was followed by shock and death. The failure of transfusion of blood from dogs in severe shock to normal dogs to produce shock in the normal dogs was another experiment throwing doubt upon, but not definitely disproving the toxic theory. Experiments (17) in which interest centered on the sequence of changes in blood pressure and in cardiac output further strengthened the case at the expense of other theories. They showed that in shock produced by trauma the cardiac output is first diminished, followed by a decline in blood pressure. In shock produced by histamine injection the opposite order holds; and in that produced by central nervous system trauma, the decline is simultaneous.

Recent experiments (21) have been performed which consisted essentially of very slow blood letting, but under spinal anesthesia. Similar results as before, eliminate the objection to general anesthesia as a possible factor. These experiments, in addition, demonstrated the importance of time lost in restoring the blood pressure to a sufficiently high level. In cases where the blood pressure was allowed to remain below 70 millimeters for a few hours, transfusion was without benefit. The theory of fluid loss is the only one in which a definite initiating factor is proved (20) and most experiments in support of this theory deal in a production of shock which most nearly simulates the type of production encountered clinically.

We may now classify acute circulatory failure upon a physiological basis. The hematogenic type refers to shock in which there is decreased blood volume, vasoconstriction, decreased cardiac output, and

decline in blood pressure. Shock from slow uncomplicated hemorrhage or trauma to large masses of muscle belong to this group. The neurogenic type is primary shock or collapse, and is immediate in onset. The primary alteration is vasodilatation depending on diminished constrictor tone due to action through the nervous system. The shock state following a blow to the testes is an example of this type. The vasogenic type depends on vasodilatation induced by agents acting directly on the vessels. Histamine probably produces most of its action in this manner. The cardiogenic type is that in which the cause is a primary disturbance of the heart itself. In this type venous engorgement rather than collapse is the rule. An example is the state following sudden hemorrhage into the pericardium. However, any given case of clinical shock is apt to be not any pure type, but a combination of several types in various proportions. It is this fact which has, in all probability, led to the advancement of so many conflicting theories to explain the phenomenon.

As to the proper treatment of shock, the above studies have rendered our concept of the problem so much clearer that we may be justly expected to institute treatment in a more rational manner than ever before. One of the oldest recorded treatments was that of blood letting, which is obviously not consistent with logical application of present knowledge. The use of vasoconstrictor drugs is indicated in primary shock, since that condition is now considered due to an impairment of vasoconstriction. In the vasogenic type we are also confronted with vasodilatation and the use of vasoconstrictors would seem logical. Indeed, Heuer (22) has demonstrated good results in such cases.

Since these are the only types in which we get vasodilatation early in the condition and vasoconstriction is the rule in the other types, the use of these drugs in the other types is definitely contraindicated and harmful. Cold, exposure, pain, and trauma should be combated, since these have been shown to play a definite role in causing or aggravating shock. The judicious use of sedatives and heat, and the prevention of further trauma by splinting, careful handling, etc., is indicated. Since blood loss, either by actual bleeding or by extravasation into the tissues, is one of the most if not the most important causes, the immediate arrest of this is the first objective.

As to the use of other drugs: Stimulants may be expected to improve the general condition of the patient temporarily, but are ultimately harmful for the same reasons as given above for the indications for sedatives. It seems safe to say that the use of digitalis in secondary shock is not at all indicated. It has been reported, also, that experimentally, it has been found to do harm and must be considered definitely contraindicated.

Since the problem confronting us is to restore and maintain blood volume and blood pressure, the most logical solution would seem to be intravenous injection of fluid. Such is indeed the case, but the problem is not so simple as it might seem. The escape of plasma from the vessels will have upset the osmotic equilibrium and the introduction of saline or glucose solutions into the vascular system causes only a temporary increase in blood volume. These substances not only leave the vessels almost immediately themselves, but carry part of the remaining plasma proteins along with them, thus reducing still further the osmotic pressure and increasing the amount of fluid in the tissues. The body attempts to compensate for this loss by further vasoconstriction, and a vicious circle is set up. The treatment indicated is a fluid which will replace the volume, provide substances which will exert osmotic pressure, and stay in the vascular bed. This, alone, will serve to break this vicious circle. Since blood plasma has been lost, blood plasma or defibrinated blood would seem the logical remedy. This is the logical remedy, but is not practical. The two substances usually employed are whole blood or acacia. Blood for transfusion or facilities for giving it may not be available. Authorities (20, 23) disagree on the efficacy of acacia. Some consider it indicated; others, not a good substitute for blood; and still others, definitely contraindicated. It is usually given in 6 percent solution and is supposed to stay in the vascular system, in considerable amounts, for about 6 days. It is incompatible with citrated blood, however. The ideal practical treatment must be considered, therefore, blood transfusion, which in addition to the above function, performs in no small part another, namely, increasing body warmth. Let us now summarize our treatment of typical secondary shock:

1. Get (and keep) the patient warm and dry.
2. Arrest hemorrhage.
3. Eliminate or minimize pain and further trauma by use of sedatives, gentle handling, splinting, etc.
4. Immediately restore the blood pressure and blood volume to adequate levels by blood transfusion, or in the most critical cases where blood is not available, by injection of acacia solution, realizing that it is, at best, a poor substitute for blood and is used only as a temporary measure until blood can be obtained.

In conclusion may I say that the problem of surgical shock is still with us and the final word has by no means been written.

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**TO WHAT EXTENT IS REALITY ADJUSTMENT CONCERNED IN THE
SELECTION OF THE FLYING TRAINEE?¹**

By JOHN W. VANN, Commander, Medical Corps, United States Navy

In Army Regulations 40-110 under subsection b (2) of paragraph 33 there will be found, among others, the words:

Study will be made of the * * * reactions concerning the ordinary stresses of life, and particularly the probable reactions under the special stresses incident to flying.

Thus we find laid down a specific mandate to investigate the types of reality adjustment the individual being examined has made for himself prior to this stage in his life at which he presents himself for flying training. It appears logical to assume that the methods

¹ Thesis presented in the department of neuropsychiatry, School of Aviation Medicine, Randolph Field, Tex.

he has used in the past are the ones he will utilize in the future. We know that some are healthy and some decidedly unhealthy, some are desirable and others undesirable.

The paragraph on reality adjustment as shown in change no. 1 of Army Regulations 40-110 states that—

In the study of the candidate a review is made of his total experience. Every candidate will be found to have met with situation difficulties requiring solution. The extent and type of the difficulties will, of course, vary with the individual. The manner in which he has met worries, handled conflicts, and sublimated complexes is an indication of the degree to which he can adjust himself to his environment. The study should determine whether he is inherently stable or unstable. The method of the candidate's reaction to reality is expressed as: By sublimation; by rationalization; by projection; by phantasy; by symbolization; by introversion; or by extroversion; any of these methods singly or in combination.

War Department form A. G. O. No. 64, the Physical Examination for Flying, contains, in section 47, the heading "Reality adjustment" and a space is left to be filled in by the flight surgeon conducting the examination. No directives are given for the use of those in the field who are examining applicants, and no doubt some confusion exists in the minds of some flight surgeons as to exactly what is wanted in this respect.

Personality studies are conducted at the School of Aviation Medicine in the cases of all candidates for flying training who present themselves for the original examination. The method in use there is to first determine into which of the two large types of personality types he falls, the introvert type or the extrovert type, and then whatever other mechanism or mechanisms of reality adjustment he uses are added, for in most cases it will be found that he solves his conflicts by *introversion* or *extroversion*, plus sublimation, or rationalization or some other combination of mechanisms.

Before going further it may be well to state what is meant by the introvert type or the extrovert type of personality and to define the mechanisms which have been mentioned. To Jung we are indebted for the origination of the terms introvert and extrovert as used in the classification of personality types and from those terms have come the mechanisms of introversion which means a turning inward, or imagination, and extroversion which means a turning outward of the mind in relation to self. Introversion is a kind of giving-up adjustment, yet it is not a complete surrender. It consists in giving up the ends sought and in substituting for them an imaginary realization. Within limits, and properly controlled, the play of imagination or identification, which is the substitution of self for another who is of the "conquering hero" or the "suffering hero" type, is productive of little harm while providing much satisfaction. The intro-

versions should be of the right sort, however, and fancy must not disregard fact or become substitutive for action. In extreme form, the adult introvert who is a person subject to excessive day dreaming would be classified as abnormal or psychotic (Schizophrenia), and the delusions of the mentally diseased appear to be exaggerated forms of the day dreaming of normal persons. Day dreams, of themselves, are perfectly normal and almost universal and bring satisfaction to most people, but in the extreme form are dangerous in that the individual permits the wish fulfillment phantasies of his imagination to supplant more healthy forms of expressions of energy.

In the extreme form the extrovert is the type which is illustrated by the various manias of manic-depressive psychosis and is as abnormally deviated in the one direction as the Schizophrenic is in the other. As stated before, by extroversion is meant the turning outward of the mind from self. All stimuli come from the external world and all the interests of the individual are projected externally. Instead of day dreaming there is action, often of the impulsive type. As a type the extrovert is versatile, energetic, realistic, subject to making mistakes, quick to anger and equally as quick to relent. The introvert type is the idealistic dreamer, the cold-blooded, calculating planner, one who is slow to act, stubborn, relentless, and a follower rather than a leader. One can use the terms introvert and extrovert only for the men who belong to the extremes in one way or other. That a person is of one type or the other is meant that he usually employs one mechanism more than the other, for most persons are found to employ both. Which of the two is the more desirable will be hazarded later.

Rationalization is defined by Noyes (1) as one of the most common defensive mechanisms by which we first act in response to unrecognized motives and, after the action, offer various supposed "reasons" for the action. It has also been described as a form of thinking or reasoning in which our personal cravings are selective factors which guarantee an agreeable conclusion. It by no means signifies logical reasoning for that would at times result in conclusions injurious to our ego. Suppose, for example, the candidate admits having tried for a place on the football team but failed to make it, and quit the squad. Now if he claims he quit because the practice periods interfered with his studies and that they were more important than his athletics, then he can be said to have rationalized his failure. In other words, he has saved his face as far as he is concerned by finding a reason for having given up the effort to make the football team, which he really was most anxious to do. He believes his behavior ought to be determined by certain motives and is led to believe it is.

Rationalization serves a useful purpose as far as psychic self-protection is concerned, and makes one more comfortable, but it leads to self-deception and may contribute to the formation of delusions. Therefore it should be considered an unhealthy and dangerous type of reality adjustment.

Projection is another mechanism of defense and is one that is utilized almost universally to explain one's minor mistakes, and in many cases the major failures as well. By projection we place the blame for our acts upon others—the earliest example, of course, being that of Adam, who blamed Eve for tempting him in the Garden of Eden. Projection is an evasive process and can be illustrated by the case of the candidate just mentioned who might have attributed his failure to the incompetence of the coach who, he claims, didn't know enough about football to build up a good team from the material he had available. We all employ projection to a certain extent but, as stated before, basically it is defensive and evasive, and is employed to such an extent by the paranoiac that it is decidedly unhealthy. In the case of a candidate who shows evidence of having employed it in the past to explain his failures it seems very likely he would blame any failure to make satisfactory progress in flying training, not on himself, but on the instructor, the plane, or the ground crew, and it also should be considered undesirable.

As mentioned before, phantasy is the process by which an unsatisfactory reality is changed into a more satisfying reality through the medium of day dreaming, and while normal in children and primitive peoples it should not be indulged in very much by the normal individual. As Noyes (1) states:

Phantasy is often the product of conflicts and is an attempt to provide greater comfort. Often, too, it is a compensatory expression. The thinking of phantasy is characterized by being autistic, i. e., by not being directed, by not being translated into action, by not being corrected by reality, by being pleasurable and wish-fulfilling in nature, by ignoring what intervenes between a wish and its fulfillment, by not subjecting its products to conscious criticism, and by being socially valueless.

This appears to be a very stern indictment against phantasy, and yet who can say but what most inventions, discoveries in the scientific world, explorations, and the like, had their origin in what at first appeared to be dreams of phantasy? Undoubtedly the dreams, the germs of an idea, must first present themselves, but action is equally important. On the whole the discovery of excessive habits of day dreaming on the part of the candidate for flying should be considered an undesirable type of adjustment to reality.

All of us are said to employ the mechanism of symbolization which consists of the representation of one idea, quality or object by another, but most of us are not conscious of doing so. Paintings, statues,

and other works of art are said to be the symbolic representations of the artist and are employed to express mental material with which much feeling is concerned. Unfortunately all expressions of repressed material that present themselves through symbolization are not in the forms which possess aesthetic value, and the disguises under which previous distressing emotional experiences may be manifested are numerous. Affectations of gait, dress, speech or manner, facial and other tics, and compulsive acts may symbolize some painful emotional experience. The presence of such in the case of the candidate being examined should warrant further inquiry and examination to determine what is back of them, and in the absence of satisfactory explanation should be considered as undesirable.

Certain other mechanisms of reality adjustment remain to be mentioned. Thus we find that there is *repression* which is the process of pushing down into the unconscious those desires, ideas, and primitive aspects of the personality which are incompatible with or painful to the individual's conscious self-requirements. As the complexes and conflicts thus repressed are merely buried alive they are liable to crop forth at some future date and cause trouble. Repression must not be confused with suppression which is the conscious attempt to forget what is desired to be forgotten by deliberately directing one's attention elsewhere when that which is undesired presents itself in consciousness. The results of repression are not always undesirable but broadly speaking they possess psychopathological characteristics.

Next we have compensation to consider. This is the mechanism by which an individual attempts to make up for inadequacies and imperfections by adopting compensatory attributes which he thinks will secure for himself the attention and recognition he craves. If of appropriate technic and limits this process is often beneficial, but when over-compensations occur they may develop into unpleasant traits of character which at times constitute the serious symptoms of psychoses.

All of the foregoing mechanisms have been shown to possess undesirable features, not so evident in some cases, but frankly psychopathological in others. What then of sublimation? Noyes (1) defines this as the mental mechanism which, by a modification of its quality, acceptably utilizes the primitive biological energy for the higher psycho-social ends of the individual. By repeated sublimation the energy is trained to discharge at progressively higher levels, resulting in a constant cultural advance, and successful sublimation is one of the most important mechanisms in the formation of sound character. Thus in the case of the candidate who failed to make the football team, as mentioned before, if we find that he sublimated his failure

and disappointment by becoming proficient in some other college activity, while at the same time there was no "sour-grapes" attitude, we would rate him higher than if he rationalized or projected them. As Gates (2) states:

Of all the methods of adjustment to the thwarting of our fundamental impulses, the substitution of some wholesome but vigorous activity, while not always the easiest to arrange, is by far the best. When the lives of men are deeply searched, great achievements are sometimes found in activities which began as substitutes for some other interest that was thwarted.

Thus it can be said that sublimation is the most desirable of all the mechanisms which have been mentioned.

Given the type of mechanism, then, that appears desirable, what is the combination of reality adjustment and personality type that we should look for in our selection of trainees? First of all, I believe, that depends to a large extent upon whether they are being trained for flying alone, to be future officers, for wartime flying only, or for peacetime flying as officers.

So far it has not been shown that having a predominance of extrovertive or of introvertive tendencies has anything to do with making a successful flyer. Pillsbury (3) states that Freyd selected two groups of men, one of which he called the socially minded and the other the mechanically minded. The socially minded excelled the mechanically inclined in excitability, self-confidence, open-heartedness, present-mindedness, good nature, adaptability, talkativeness, neatness in dress, and quickness to make friends, while the mechanically minded were somewhat more self-conscious, conceited, and careful of details, and were capable of making finer coordinations. The socially minded were largely of the extrovert type and the mechanically minded the introvert type. Proceeding further along these lines, we find that in the tentative revision of the physical standards for aircraft pilots proposed by the chief of the medical section (4), Bureau of Air Commerce, the statement is made that we form four general fundamentally inherent types, viz: (1) The effective extrovert; (2) the effective introvert; (3) the cognitive extrovert; and (4) the cognitive introvert; and that they are best suited for heavier-than-air craft in the order named. To quote further:

Aviation is man's latest development and is activated by social dictates. It appeals largely to this side and extroversion supplies the urge for this new means of transportation. We must have people of the sportsman type to fly a ship safely.

This is undoubtedly true from the standpoint of private flying and possibly of commercial flying, and would be of the utmost importance in time of war, as it is believed the extrovert would last longer as a military flyer under war conditions than the introvert. In times of

peace there are places for both to fill—the extrovert to use his flying knowledge and ability in the air, the introvert to use the same knowledge and ability in research, aeronautical engineering, and in administrative details.

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COPPER SULPHATE TREATMENT OF TRICHOPHYTOSIS

By JAMES B. MOLONEY, Lieutenant Commander, Medical Corps, United States Navy

Under the name "athlete's foot", so well popularized in newspapers and magazines, trichophytosis is probably better known than any other skin disease. Although it was until a comparatively short time ago almost exclusively a tropical skin disease, it is today well nigh a cosmopolitan dermatosis. It has many names in various places. Dhobie itch, eczema marginata, dermatosa bullosa, dermatitis rimosa, eczematoid dermatitis, dermatomycosis, tinea circinata, waikiki itch are just a few of the names of this mycosis.

The etiological factor of trichophytosis is a fungus, *Epidermophyton*. This organism can be recovered from the fresh lesions and can be cultivated in the laboratory. Fungi are ever present in the air, and are probably the cause of many allergic manifestations. They are one of the lowest forms of vegetable life, are without chlorophyl, reproduce asexually by spore formation, and are either saprophytic or parasitic.

The pathology of trichophytosis is essentially a subacute or chronic inflammation involving at first the superficial and later the deeper layers of the skin. The formation of bullae or pustules is probably due to secondary invasion of the skin by staphylococci. Many lesions of the skin of the feet show a remarkably symmetrical distribution. Whether this is due to a nervous condition giving rise to trophic disturbance of the parts or whether it is due to a reduplication of the conditions suitable for the growth of the fungus it is impossible to say.

Clinically, the disease is manifested by sharply demarcated areas of erythema with vesicles and pustules. The erythematous areas are usually discrete and increase in size at the periphery, frequently coalescing. The eruptions have periodic exacerbations during which

the itching may be intense. The intertriginous regions of inner thigh and the interdigital spaces are especially liable to become infected.

It has been known for some time that copper sulphate has a remarkable effect upon these low forms of vegetable life. In a dilution of 1 to 1,000,000 it will inhibit their growth and in a slightly stronger concentration it will destroy them. Since February 11, 1937, at the submarine base, Pearl Harbor, Territory of Hawaii we have been treating trichophytosis with copper sulphate, with very encouraging results. A series of 50 consecutive cases have been treated and in every case a complete cure has been effected. Only 5 cases showed recrudescences and these quickly responded to retreatment. The treatment consists of daily application and thorough rubbing in of a 20-percent solution of dehydrated copper sulphate in chemically pure glycerine. The copper sulphate is dehydrated by heating in a porcelain dish over a Bunsen burner to a constant weight, before weighing. Special care must be used to preserve the mixture from moisture as both the glycerine and the dehydrated copper sulphate are strongly hygroscopic. This preparation is thoroughly worked into the affected area by inunction for 15 minutes by the clock every day. The excess is then removed and a dry sterile dressing applied. The copper sulphate treatment is offered not as a substitute for any of the recognized methods of treatment, but as an alternative treatment in those cases which prove refractory to the usual methods of treatment.

ORAL DIAGNOSIS AS A PROCEDURE IN INDEXING GENERAL DISEASES MANIFESTED IN THE MOUTH¹

By CURTISS W. SCHANTZ, Lieutenant, Dental Corps, United States Navy

The modern conception of oral diagnosis covers a broader field than ever before. Today the ability of the diagnostician to differentiate one lesion from another calls for an understanding of the pathologic development of disease, because through this interpretation lies the success of treatment. In addition he must also be able to determine the etiologic factors of both local and systemic disease and thereby when instituting treatment he will know how to systematically eliminate the cause of the disease and its ensuing end products. A diagnostic acumen then will result in the materialization of that oft-repeated adage, "An ounce of prevention is worth a pound of cure."

¹Based on work done at Columbia School of Dental and Oral Surgery. The author acknowledges with appreciation his indebtedness to Doctors Lester Cahn and Daniel E. Ziskin for instructions received under their supervision.

Oral diagnosis can best be defined as the art of distinguishing one disease from another. It being understood, however, that this requires experience and careful correlation in clinical and laboratory procedures. The most commonly used methods are:

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| 1. Clinical. | 6. Laboratory |
| 2. Differential. | 7. Physical. |
| 3. Direct. | 8. Roentgenographic. |
| 4. Exclusion. | 9. Serological. |
| 5. Biological. | |

The determination of methods applicable in each case must be developed from the aspects presented by the case at hand. Prior to the examination it would be well to mention here some of the important steps in the preexamination procedure in which observation of the patient gives the diagnostician valuable leads as to what he may expect to find. For example, as the patient is being ushered into the examination room, the diagnostician should observe the patient's characteristics such as gait, color, general physical development, and appearance. It can be readily understood why this is of value, for often a patient presenting himself will present outwardly obvious signs of being sick. After having noted the above-mentioned characteristics the diagnostician should make a thorough acquaintance with his patient and this is an ideal time to record the following pertinent facts:

1. Chief complaint.
2. Gross family history.
3. Personal history: (a) Occupation, (b) habits, (c) weight, (d) marital.
4. Past history: (a) Diseases, (b) operations, (c) accidents.
5. Present illness: (a) What the patient tells about his present condition. (b) events leading up to the present condition.

This information should be considered as supplementary to the medical history taken by the medical officer in attendance which can be obtained, if additional data are desired.

The next steps indicated would be the following:

1. Relief of pain (when cause is obvious).
2. Prophylaxis.
3. Full mouth Roentgenograms.
4. Impressions (study models).
5. Complete case history.

With the preexamination data and procedures complete, the diagnostician can proceed with the oral examination by observing the following:

Oral tissues.—(a) Cheeks, (b) lips, (c) throat, (d) ulcers, (e) swellings, (f) color of tissues, (g) gingivae, (h) loss of stippling, (i) palpation (both hard and soft tissues).

Occlusion.—(a) Alignment, (b) shade, (c) mold, (d) pathology.

Exploration (for caries)—(a) Occlusal, (b) buccal and labial, (c) lingual.

Roentgenograms.—A careful comparison to findings with particular attention being directed toward apical changes, investing bone, and investing tissues.

In regard to symptoms found in a careful examination and those presented in the case history our naval patients can be divided into two distinct classes. Those that are driven to seek relief because of subjective symptoms and those who seek, out of personal interest, routine examinations. The exceptions being the recruits. The most common of subjective symptoms are: A consciousness of a growth or swelling; bleeding; and, largely, pain.

Swelling or growth may present:

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| 1. Tumor or cyst. | 3. Paget's disease. |
| 2. Osteitis fibrosa cystica. | 4. Atypical gumma. |

Bleeding of the gum and oral mucosa may be caused by:

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| 1. Blood dyscrasias. | 3. Endocrine imbalance. |
| 3. Local inflammatory conditions. | 4. Avitaminosis. |

Pain may be due to:

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| 1. Ordinary toothache (caries). | 4. Gingivitis and stomatitis. |
| 2. Reflex odontalgia (sinus infections). | 5. Painful, loose, and sore teeth. |
| 3. Burning, soreness of tongue and mouth. | |

Subjective symptoms noted by the patient may present objective findings to the diagnostician in his clinical and roentgenogram correlation. The most common are:

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| 1. Dental caries. | 5. Leukokeratosis. |
| 2. Parodontosis. | 6. Geographic tongue. |
| 3. Secondary syphilides. | 7. Pigmentation. |
| 4. Lichen planus. | 8. Foul breath. |

The most common of subjective symptoms confronting the diagnostician is pain. If it is of local origin it is easily discovered and relieved, but many of our dental symptoms are not of dental origin.

Sore burning tongue and mouth are not infrequent and many times the pain exceeds any visible lesion. Such a condition is typical in Addison's anemia and may be present for some time before any blood changes can be demonstrated. If mouth soreness is found associated with digestive disorders and numbness of the extremities, pernicious anemia should be suspected. A smooth, clean, and polished tongue with atrophic papillae is strongly indicative of primary anemia.

Sprue has manifested itself in a sore tongue and digestive disturbances, but as a rule there is less atrophy of the lingual papillae.

Herpetic ulcers are associated with digestive disorders and are also seen in acute infections thus presenting a complex problem in diagnosis. These particular symptoms present themselves frequently in

the daily average practice and it is for this reason the diagnostician must depend on his diagnostic acumen if he is to properly guard his patient against the inroads of disease.

Acute gingivitis is one of the most common of oral conditions. Practically all cases of acute gingivitis are of bacterial origin, but what may be the underlying causes for lowered resistance of the gingival tissues permitting infection to take place, presents a further complex problem. In the past few years much has been heard about Vincent's gingivitis. The term should be discontinued. The mere ascertaining of the fuso-sprillary combination means nothing, because they can be demonstrated in every inflammatory area in the gum. In fact, they can also be demonstrated in healthy normal gum. They are found, however, in increased numbers in inflamed areas.

Recent careful observers (Becks, Lueck, Lichtenberg, and Werner, for example) have pointed out the folly of making smears from gingival and oral lesions and basing diagnoses on them.

Acute gingivitis, especially where there is a gangrenous ulcerous picture, is frequently accompanied by systemic conditions. Pernicious anemia, the leukemias, and agranulocytosis exhibit an ulcerous gingivitis during some phase of the disease. This is especially true of leukemia and agranulocytosis.

Diabetes, endocrine deficiencies, and avitaminosis predispose the gum to secondary infection. Lack of hygiene, too, often is a predisposing factor to the acuteness of the gingivitis.

An acute gingivitis demands at all times a thorough examination to determine if a contributing factor exists. Along with a complete case history should be included a red, white, and differential blood count and urine analysis. A Wassermann or Kahn test is also indicated. By this thorough method of exclusion we can distinguish whether or not we are dealing with a pure local infection and institute the treatment indicated. Where it is found that a systemic contributing factor is involved, consultation with the medical officer is imperative. If gingivitis is found secondary to a general disease, such as blood dyscrasias, the mouth is merely kept in a condition as antiseptic as possible.

The popular cause for discomfort in the oral cavity is the loose and painful tooth. It would seem apparent that this would be easy to diagnose, but often this is not the case. A vast majority of loose and painful teeth are caused by paradentosis and because of this condition being universally accepted as the cause, often lymphatic leukemia has been overlooked. Neoplastic invasion may loosen teeth and sometimes it is the first danger signal that something is amiss.

Bleeding from the gum and oral mucosa often sends the patient to seek advice and relief and it is frequently caused from gingivitis

due to lack of mouth hygiene and tartar deposits about the teeth. The type of bleeding that is sudden in its onset and causes a steady oozing from the gum and membranes accompanied by petechial hemorrhages in the skin may have a serious underlying cause; namely, idiopathic purpura, primary and secondary anemia, acute leukemia and avitaminosis. Here blood examination aids in establishing the proper factor, it being remembered that in early stages of acute myeloid and lymphoid leukemia the white blood count may be normal. Because of the incipiency of these diseases a careful search should be made of stained blood smears for myeloblasts and lymphoblasts and continued blood counts too are indicated so the changes may be noted promptly. In the case of idiopathic purpura it is well to look for a diminished platelet count.

Growths and swelling are usually objective in their symptoms and the patient comes to the dental officer for relief when he becomes aware of such abnormality or someone has called his attention to it. A localized exogenous tumor is rather easy to diagnose, but following its removal an histological examination is imperative. Lymphoid leukemia may at times give rise to a circumscribed growth, due to leucocytic deposits. This condition often precedes blood changes so this histologic examination will give the first clue to its presence. Likewise a giant-cell tumor may prove to be from a generalized osteitis fibrosa. It has been found that wrong diagnosis of giant-cell epulis was later found proven to be a primary tumor of the jaw.

When a central lesion in the bone is evident by expanding bone plates we may be dealing with a simple cyst caused by a pulpless tooth, a region where a tooth has been recently removed, or with an unerupted tooth. If the roentgenographic examination reveals a cyst not associated with a tooth, a definite diagnosis becomes essential. It is not uncommon that these prove to be neoplasms such as an adamantinoma, giant-cell tumor, myeloma, or even one of the rarer diseases such as Gaucher's disease or Niemann's disease. Diagnosis should be based on good roentgenograms and a biopsy for a complete histologic examination. Further laboratory tests such as blood and urine are indicated.

It is not uncommon to see swellings in the mouth which may not be typical gumma. Such lesions may resemble subacute abscesses of the alveolus or take the appearance of typical gum boils. Their appearance topically often is very misleading and it is found that antiluetic treatment causes a rapid disappearance. Mucous patches or excoriations should always present suspicions of lues if for only self-protection of the operator.

Tuberculosis is encountered in the oral cavity in the form of either an ulcer or a tuberculoma. Such lesions often manifest themselves

after tooth extraction. Here diagnosis can be established on histological examination.

There are a number of conditions to be remembered which do not present subjective symptoms and are usually discovered through clinical and correlation of roentgenographic findings. The most common of these being caries and paradentosis. Both of these conditions appear to be of unknown systemic origin. Calcium and phosphorus imbalance are undoubtedly the cause, but just what brings about such imbalance is still a matter of scientific conjecture. It is recognized that diet, metabolism, and endocrine deficiencies undoubtedly are factors in their cause and eventually scientists will solve the underlying reason for their prevalence.

Linchen planus is often seen in the mouth associated with skin manifestations.

Foul breath is frequently noted in patients and may be due to a condition of oral filth, digestive disorders, or nasal infections.

Pigmentation in the gum is frequent. In the case of certain patients it is a racial characteristic. The importance of pigmentation to the diagnostician is where it seems abnormal in position. Often such pigmentation may prove to be foreign bodies such as fragments of metal, broken burs, explorer points, or amalgam which has been accidentally projected into the tissue or into open wounds during surgical procedures. The appearance of lead and bismuth pigments is easily recognized and the cause for such manifestation is today well understood. Laidlaw and Cahn have demonstrated melanoblasts present in the gums and these when activated will cause a brownish pigmentation often seen in chronic gingivitis. Bronzing of the oral mucosa suggests Addison's disease.

The importance of recognition and correlation of abnormal oral pictures cannot be overemphasized. Correct and timely diagnoses will do much in fulfilling the duties of the dental surgeon to his patient. It is hoped that this résumé will present a workable method for correlating mouth symptoms and septic disease.

HEPATITIS, ACUTE

By JULIAN LOVE, Lieutenant, Medical Corps, United States Navy

The diagnostic title "cholangitis, acute" is one that has been used by all medical officers to report a fairly common condition among naval personnel, which is also known as catarrhal jaundice. This condition usually begins with a general feeling of malaise, marked anorexia, and constipation. Shortly thereafter a yellowish tint appears in the sclerae, skin, and mucous membranes and progresses in

intensity until it is noted either by the individual himself, or his associates. Occasionally, there is a mild fever and pain over the hepatic region, and sometimes there may be described a clay-colored stool. Often the patient notes a dark color and foaminess about his urine. Most frequently the yellow flag of scleral icterus drives the patient to the doctor even though he is really not sick, but jaundiced.

In fact, with the appearance of the icterus the distressing symptoms often vanish.

On physical examination one usually finds a well-nourished individual not acutely ill, but with an obvious yellowness of his eyes, skin, and mucous membranes particularly on the soft palate and inferior surface of the tongue.

Sometimes the lower edge of the liver can be felt and more often there is tenderness in this area. The diagnosis is usually clinched by urinary tests for bile pigment. The Gmelin test in which a play of colors is noted when nitric acid is added to a drop of urine; or the Smith test, in which a green ring appears at the contact zone if the urine is overlaid with 0.7 percent tincture of iodine, are the most commonly used. Mere inspection of the color of the urine is often sufficient, and one may also prove the diagnosis by sprinkling flowers of sulphur (Hay's test) on the urine which if positive will cause the sulphur to float. Urobilinuria is increased. The Vandenberg test of the blood serum which is positive immediately by direct and indirect methods, the icterus index which is usually much higher than the clinically evident 16 units, and the serum bilirubin which is greatly increased are serological proofs of the diagnosis. Unless, as rarely happens, it is a forerunner of a more serious hepatic involvement such as acute yellow atrophy or a result of drug or anesthetic intoxication, there is little to confuse one from a differential diagnostic standpoint. Clinically the unusual carotinemia may confound momentarily. The condition usually lasts from 3 weeks to 3 months during the major portion of which the patient is able to carry on his full duties, and other than digestive distress caused by ingestion of fatty foods may be quite well. One attack seems to confer immunity for it appears to be very rarely that a second attack occurs in one individual.

The commonly accepted explanation of the pathology of this disease first advanced by Virchow (1) in 1847, was that of a gastroduodenal catarrh in which a plug of inspissated mucus was impacted in the duodenal ampulla (Ampulla of Vater) following which there was a mechanical blockage of the bile and an ascending infection of the bile ducts of this region. Thus was born the diagnostic title of "cholangitis acute" which supposedly described the etiology and basic pathology of this disease. Because of the mildness of this disease, deaths very rarely occur, and the opportunity for postmortem study

of this condition has been infrequent. Klemperer (2), however, found on biopsy that there was a true parenchymatous hepatitis with cloudy swelling and fatty degeneration of the liver cells. Eppinger (3) has been unable to find any pathology in the bile ducts, but his observations in the liver parenchyme are in accord with the former author. Flusser (4) in 1918 autopsied two cases who died of influenza and found only parenchymatous degeneration in the liver. Alter (5) in his extensive studies of necropsies agrees that the disease process is an acute inflammation of the liver proper, and that the bile ducts are unaffected. Taylor (6) states that the primary disease site is in the liver, and Schrumpf (7) from biopsy studies in his case concluded that he was dealing with an hepatolytic parenchymatous icterus with no angiocholitis.

That this condition could not be one of primary involvement of the bile ducts can be shown in many other ways. First, clinically: If the disease were simply a cholangitis the liver cells would continue to manufacture bile and the overflow would, according to the law of Courvoisier, be into the gall bladder giving a hydropic condition of that organ instead of a backflow into the general circulation with the appearance of jaundice, bilirubinemia, and urobilinuria. Then, too, although the stools are relatively acholic at the onset, this is not absolute, and, in any case, after a very short period one is able to obtain bile by the Lyon-Meltzer drainage method even though the jaundice persists as strongly as ever. Furthermore, in true cholangitis the clinical symptoms, of pain, fever, chills, and general toxemia are much more severe, and the prognosis does not carry the almost 100 percent optimism that is characteristic of catarrhal jaundice.

Secondly, from a laboratory standpoint: In the use of the dyes, bromsulphalein, azorubin S, rose bengal, and others of this class there is always a marked retention which could not occur if the hepatic parenchyme were normal. In a similar way the galactose tolerance, levulose tolerance, and hippuric acid synthesis tests which indicate hepatic parenchymatous activity are found to be deficient in function and in this the bile ducts take no role. In other words this jaundice is of hepatic and not obstructive origin.

Thirdly, from roentgenological studies: The Graham-Cole test either by oral or intravenous methods of visualization of the gall bladder, by phenoltetraiodophthalein shows a failure to visualize during the active, jaundiced, stages of the syndrome. A retention of the dye may be demonstrated in the blood stream. However, when the jaundice disappears if the test is repeated normal visualization will result. The absence of gall-bladder shadow in the active phase does not indicate cholecystic disease, but simply that the liver parenchyme was unable to pick the dye from the blood stream for storage and concentration as normally occurs.

A knowledge of the above aids in treatment. A fat-free diet as usually prescribed prevents the patient from digestive disturbances because with the absence of the bile coenzymes to aid in fat digestion, distressing symptoms of indigestion occur. Pancreatic function apparently is undisturbed, which is further proof of the patency of the duodenal ampulla. More important in the light of our newer studies of hepatic pathology is the prescribing of a high carbohydrate diet, for dextrose is the specific remedy for liver dysfunction, and the fact that a fat-free diet usually makes a high carbohydrate diet mandatory for caloric requirements accounts more for the success of that diet than for its original purpose, which would be served better by the prescribing of the bile salts or *fel bovis*. In obstinate cases the use of insulin with dextrose has been proved of value. The sodium phosphate prescribed as a rule has served as a satisfactory aperient and is probably as good as any mild laxative, though not particularly better, to overcome the tendency toward constipation which is another function of normal bile. Further, there can be no indication therapeutically for duodenal drainage, and this procedure has not succeeded in lowering morbidity.

From the above it is felt that both from the scientific and practical viewpoints the diagnostic title "cholangitis acute" is a misnomer for the condition often referred to as catarrhal jaundice. A better conception of the disease and a basis for more logical treatment and a shortening of the duration of the morbidity would result from the adoption of the diagnostic title "Hepatitis, acute (infectional)—specify organism when known." This title has been advocated by the Standard Nomenclature of Diseases, compiled by the National Conference on Nomenclature of Diseases.

CONCLUSIONS

1. The diagnostic title "cholangitis acute" to describe the clinical condition known as catarrhal jaundice is based on a previously incorrect conception that the disease process is located in the bile ducts.
2. Studies from clinical, laboratory, roentgen, and biopsy standpoints show that there is a true parenchymatous involvement of the liver cells.
3. A correct diagnostic title, Hepatitis acute (infectional) has been proposed to replace "cholangitis acute" for this syndrome, and is felt to be of value in a practical as well as scientific understanding of the treatment of this disease.

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A STUDY OF SYPHILIS IN THE NAVY

By D. T. PREHN, Lieutenant, Medical Corps, United States Navy

The syphilitic in the Navy has certain definite advantages over the general run of civilian syphilitics. The man in the Navy is in general good health, is from a well-regulated environment, free from financial burden, especially insofar as medical care is concerned, and is continually under the hygiene control of a well-equipped medical corps. These factors, in addition to others, make the management, especially of early and latent phases of syphilis, more or less a machine affair. It must be admitted that routine procedures are both fallible and dangerous in the treatment of patients with any disease. While individualization is always desirable, the necessity for standardization in the treatment of syphilis is of great importance and usually can be put into practice under service conditions. A comparison of our methods with those whose opinion we consider expert is made here to point out the necessity for improvement in our management of syphilis: "Incline to system early and to individualization late" is Stoke's (1) pointed summary of the above.

The earliest possible diagnosis of syphilis is paramount. Syphilis diagnosed before positive blood serology removes a 25- to 35-percent hazard from the patient's chance for complete and lasting cure. Stokes (1) states:

It is probably fair to consider that the expectancy of syphilis underlying genital lesions of all types ranges between 60 to 85 percent with the application of all modern methods to its diagnosis. A darkfield efficiency of over 90 percent should not be too much to expect.

The usual procedure of obtaining two or three darkfields and then discontinuing the search, if these have been negative, is to be condemned as insufficient. Among 506 syphilitic abstracts studied by this writer only 119 cases were diagnosed with the darkfield; the others were with the aid of a positive serology. The usual single technique to obtain the serum, as practiced by the pharmacist mate, is entirely inadequate and in some methods personally observed, even faulty in its simplicity. The use of normal saline or local alcohol application to stimulate serum production from the deep layers of the

lesions, the use of suction by several simple devices, the use of aspiration either of the lesion itself, its surrounding borders, or the adjacent lymph nodes, the deferred darkfield technique are not commonly known or practiced by our laboratory technician. The local Wassermann or Kahn reaction in the diagnosis of early syphilis is mentioned here to encourage its use in our service. Reports on this procedure found it more frequently positive in known cases than either the darkfield or the blood serological reaction at the time the local Wassermann was done.

Stokes (1) states:

The time will come when to make a positive diagnosis of chancroid until 4 months have elapsed since the appearance of the lesion will be regarded as naive and a proof of the physician's unfamiliarity with the modern clinical diagnosis of syphilis * * *. The diagnosis of chancroid, let it be emphasized, is no longer positive but negative.

In the study of 600 chancroid case records at the Canacao Hospital not a single diagnosis was established on the finding of the *Bacillus Ducrey* or by a positive Dmelcos skin reaction. Only 25 percent had more than one darkfield examination.

In the observations by Stokes et al. (2) for the United States Public Health Service on 75,000 cases of syphilis, and in the League of Nations investigations (3) covering 93 clinics and 13,198 case records, and lately Stokes et al. (4) report on 6,807 cases in his clinic, together with numerous observations by many of America's most qualified observers, one is led to the unescapable conclusion that continuous and prolonged treatment of early syphilis is essential for the best eventual cure. "Syphilis is never knocked out but worn out" (1).

A complete neurophysical examination after the diagnosis is established is necessary. In some cases, when indicated, an investigation of the spinal fluid, roentgen examination of the heart, etc., should be recorded on the abstract before treatment is started, or soon after treatment is started. This was not shown on any of the 506 abstracts.

Usilton's statement, "syphilis as a treatment problem ranks first among the contagious diseases of man" (1), should impress the physician of the importance in the proper treatment. The treatment attack, after the diagnosis is made in early syphilis, is preferably made with both an arsenical and a heavy metal. Initial intensive treatment is best if the patient's physical make-up can withstand the assault. Practically all Navy patients can readily tolerate this intensive early attack. The courses are then overlapped as to heavy metal and an arsenical at the end of each course, until a minimum of 75 weeks of continuous treatment is completed, preferably more, and, certainly more in the sero-positive case, to a minimum of 3 years. If the blood serology and the spinal fluid are found negative and there

are no neuro-physical signs of relapse, then only may the treatment be stopped, with a recommendation that there be later check-ups. Our most modern treatment does not assure a cure; therefore, the patient should be kept under observation at various intervals of time until we can assure him of absolute cure.

The 506 syphilitic abstracts studied represent some from the Asiatic Fleet; namely, the *Blackhawk* and 6 destroyers, the *Chaumont* and its draft, including marines, the *Rigel*, *Altair*, and 6 destroyers of the Battle Force. In all cases selected the treatment had been stopped for over a year; 67 cases originated before 1925, 142 before 1930, and the remaining 297 after 1930.

Of the 506 cases 61 had 75 or more weeks of treatment; 110 had 60 or more weeks of treatment; 159 had 50 or more weeks or about a year of treatment; 69 had 10 weeks or less of treatment; 46 had continuous treatment of which only 6 had 60 or more weeks of treatment and 37 of the last-mentioned cases had an initial positive blood serology of which 4 remained positive. It is quite evident from these tables that our treatment of syphilis in the Navy has not conformed to the standards set forth by the experts. Approximately 32 percent had a year's treatment, and most of these were with longer rest intervals than the 6 weeks' limit. None conformed to a set standard, but all were of the intermittent type of therapy. Three-fifths of the cases had 32 or less injections of an arsenical. Thirty-five of the 506 had arsphenamine; 11 had sulphoarsphenamine. All the others were treated with neoarsphenamine. One-fifth of the cases had no bismuth; 35 percent of the 506 cases had no mercury. Treatment with K. I. was recorded in 48 abstracts. One case diagnosed as syphilis had no treatment. Two cases had no arsenicals. One of these had some mercury, and the other had some bismuth and mercury.

There were 21 cases where the arsenicals were stopped for some unexplained reaction. Eight of these occurred in my division duty and, after a negative patch test, treatment was resumed following a course of bismuth. The preliminary bismuth or mercury to pave the way for an arsenical was given to prevent treatment paradox. These 8 cases had no reaction, all successfully completed a course of neoarsphenamine, and an additional arsenical course was recommended after 10 weekly intramuscular bismuth injections. These cases were prepared with the Bezredka method, namely: 1. Imperial drink (sodium citrate and potassium bitartrate each a dram t. i. d. in a glass of water, the day before and the day following the injection of an arsenical). 2. Fischer's solution, preferably given by proctoclysis, 30 drops per minute, 200 to 500 cubic centimeters in 24 hours to be retained the night before the injection. 3. Seidlitz powders (double) the night before the injection and repeated the day of the injection. 4. Rest in bed 4 hours before the injection and 4 hours after. 5. Ars-

phenamine or neoarsphenamine one-tenth of the dose diluted to 10 cubic centimeters, given very, very slowly, followed 45 minutes later by the rest of the dose. 7. Adrenaline minims X. hypodermic injection, if the reaction occurs.

Fischer's solution:

Sodium carbonate crystallized (not bicarbonate) c. p.....	10
Sodium chloride c. p.....	14
Water distilled qs. ad.....	1, 000

Fischer's solution made up in ampules ready for instant intravenous injection should be in the reach of every doctor giving arsenicals for emergency use when a reaction occurs.

The alkalization of the body was done, as a modification of the above-described procedure, with sodium phosphate and sodium citrate to the point of mildly alkaline urine, where the drugs mentioned above were not obtainable.

The reason for giving a laxative the day after the arsphenamine is because of reports like those of Clausen and Jeans (1) who placed the rate of elimination by the stools five times as rapid as that by the urine.

The arsphenamines do not react directly on the micro-organisms but the effect is produced by the decomposition products. Before the method of this delayed action is worked out, as at the present it is not fully understood, not only the metabolism of the chemotherapeutic compounds by the body but the metabolism of the protozoa must be understood (1).

The toxicity of an arsenical on the kidney has been rated by Schamberg, Kolmer, and Raiziss (1) as only one-fiftieth that of mercury. The disposition of the trivalent arsenicals to injure the vascular system affects every aspect of their reaction-producing quality and must constantly be borne in mind in the therapeutic use, while the effects of these drugs on the kidney, could, were they used exclusively, be almost forgotten. This was borne out in the American Cooperative Clinical Group study of complications during treatment for early syphilis. The emphasis placed on urine examinations, especially the albumin test, as a basis for discontinuing treatment with arsenicals instead of a careful microscopic examination of the urine, is stressed here to show the unimportance of routine urine analysis when compared to other more important examinations.

Acetarsones has been used in the treatment of amoebic dysentery, lambliosis, malaria, yaws, relapsing fever, and typanosomiasis. There is a definite place for this useful drug in our armamentarium to combat diseases including syphilis. Prophylaxis or preventive treatment with this drug would be hazardous because there is a possibility of an abortive delay in the appearance of syphilis. A number of authors claim this drug appeared in the spinal fluid in sufficient vulnerable concentration to be of spirillicidal value. It

may particularly be useful as an antisyphilitic drug in conditions where the use of the usual specifics have failed to improve the condition. An example of this was manifest in two cases returned to the States from the Orient on the *Chaumont* in 1930. These two patients had multiple, ulcerative, very painful lesions from 1 to 4 cubic centimeters in diameter covering the extremities. They resembled the described malignant type. The primary lesion was diagnosed in China where they received 914 and bismuth. The chancre cleared up, but after a treatment-rest interval there was a relapse and multiple open lesions appeared as described above. Their blood serology remained positive throughout. Their transfer to the Canacao Hospital did not improve their condition. Both cases were transferred to the *Chaumont* as stretcher cases in a debilitated, emaciated, and almost cachectic condition. The ulcers were so tender and painful that only normal saline wet dressings were tolerated locally and the symptoms of pain required sedatives like codeine. In view of their past treatment with arsphenamine neoarsphenamine, sulphoarsphenamine, K. I., bismuth and mercury in combination or as a single drug, stovarsol, as suggested by my senior medical officer, Dr. Paul Wilson, was started. Daily oral 1 gram doses for 5 days, then a rest interval and then another course was our procedure. The response to this therapy was striking in view of their past history. The lesions lost their painfulness and the dirty appearance of the base cleared up after the first course. Both patients' general condition improved rapidly with evident gain in weight. When we arrived at Mare Island they were ambulatory. Their ulcers were almost healed and they were symptom free. They each received four courses of acetarsone, with K. I. orally during the rest intervals. Conversation with Dr. George McKee about these cases a few months later explained the result of this type of treatment. He stated, in his experience, this was characteristic in certain patients when different specific drugs, used alone, or in combination with other drugs, in different dosages, different intervals of time, with or without rest intervals, frequently improved their condition.

Stovarsol is also useful in treating a traveler like in our service when men are on arsenical therapy on a duty without available medical officers. Acetarsone is not a substitute for the arsphenamines, especially in early syphilis. However, it can be used in the later phases of lues, in select complicated cases like the one example cited, in cerebro-spinal syphilis, in children, arsenical reaction cases, or in the traveler away from a doctor. This pentavalent arsenical orally administered is relatively free of complications especially after standard methods have been tried and when used in the recommended moderate doses.

Stokes (1) states:

theoretically, the spinal fluid of the patient with early syphilis should be examined just after the third arsphenamine injection, provided there have been no indications for its earlier performance, such as severe headaches, meningismus, or symptoms from the cranial nerves.

This has been not always the procedure in civilian medical practice because of the physician-patient relationship, or associated expense of further treatment. It is plainly evident this condition is different in the service.

Stokes (1) in his new book says:

in all positive blood serology on the first examination treatment decisions are made in the dark without spinal fluid examination and if the puncture is refused or possibly contra-indicated, one should proceed as if the fluid were abnormal * * *. The state of the spinal fluid must be known before suspending the treatment of an early case. If it is abnormal the most serious forms of neuro-recurrence and ultimate grave complications may be expected to follow a rest period or the stoppage of treatment. No resistant or fixed positive blood serology can be interpreted or dealt with without spinal fluid examination. Such tests frequently mean concealed or asymptomatic neurosyphilis * * *. Of course the treatment of neurosyphilis means repeated spinal fluid examination * * *. It must be borne in mind that a spinal fluid examination as late as a year or 2 years after treatment is suspended may fail to reveal the subsequent relapse case. It is, therefore, a necessary precaution periodically in every case, more especially the rest interval treatment cases * * *. The earlier in the course of a syphilitic infection the spinal fluid examination is done, the higher is the proportion of abnormal findings. Abnormal findings are found in the primary stage from 7 to 25 percent of the cases; in the fully developed secondary stage untreated, an average of 40 to 45 percent; in the treated, 24 to 26 percent. It is from this group that the tabes and the paresis, the vascular accidents, and the multiple manifestations of the cerebrospinal syphilis are in the later years recruited. Abnormalities of the spinal fluid, often of the most pronounced type, precede by months or even years the first signs that can be elicited by neurological examination and the first appearance of symptoms of a subjective type * * *. It has become apparent that there is no necessary correlation between symptoms and spinal fluid changes, so that a person with every serological evidence of severe neurosyphilis may have no symptoms or other neurological findings, while one with severe symptoms may have a normal fluid. The failure to insist on spinal fluid examination may rank as culpable negligence.

It has been my experience that no patient in our service—I recall two failures with V. B. P.—ever refused a spinal fluid examination, if the disease, its complications and its vulnerable fury which lack of knowledge and proper treatment creates, were carefully and patiently explained to the patient. When properly prepared and carefully done few experience post spinal complication. When they do occur confidence need be established to assure no serious result and that his symptoms shall soon leave him.

Of the 506 cases, 68 had negative spinal fluid examinations recorded and 9 had positive spinal fluid reports. These nine, except for one, positive cases had only a single spinal fluid study at the time of

examination of the abstract. The one case had two positive spinal reports and following fever and tryparsamide therapy a negative report on the last examination. Therefore, of these 506 cases only 15.21 percent had spinal fluid examinations.

Spinal fluid examinations done on 20 cases picked at random from Destroyer Division 5 revealed 7 with positive serological findings. The first five sent to the hospital arrived there in the morning with no preparation, were examined at 10 a. m., were kept on their backs until 4 p. m., and then allowed to go home. All five developed post spinal headaches, two remained in their bunks for 4 days until relieved. The next three groups were given 15 grains of Barbitol. They were told to take 5 grains the night before, 5 grains 1 hour before the examination, and another 5 grains right after the examination. They were told when they left the hospital to avoid driving a car, were told to walk back or ride back in a street car. Only one developed a mild post spinal headache complication. H. C. Torbert (5) compares 218 ambulatory cases with 100 hospital cases and reports the number of reactions occurring in the two groups did not differ significantly. The duration of symptoms was shorter in the hospitalized patient and would be recommended only for that reason as a preference. Wise (6) makes the comment that in many European clinics lumbar puncture is a routine procedure and is not regarded unsafe or risky, as established by many writers.

It would seem, therefore, that all our naval syphilitics could readily have spinal-fluid examinations. The findings, I am sure, would be gratifying to the medical officers interested in this disease as a specialty. The interpretation of the findings, of course, depends upon the accuracy of the laboratory. Stokes states (1):

a cell count made immediately from the fluid obtained in the third tube, counted above four cells, along with another finding or findings, as a gold curve above 222, a positive globulin, or a one plus Wassermann or Kahn places the fluid under suspicion of early C. N. S. invasion, and certainly calls for further study. Now anything higher than these findings makes it probable, and, a still higher finding * * * positive evidence. If there are clinical symptoms or signs to corroborate these serological signs, the question of establishing a diagnosis of cerebrospinal syphilis is unquestionable; and, specific fever therapy and intensive chemotherapy is paramount. It is the borderline case that requires intelligent, expert interpretation, and what is more important, further careful search for the cause of these potential abnormal signs. The patient should not be dismissed with a remark * * * it is within normal limits, or the cell count was not properly done, etc.

The question of relapse and reinfection is generally not clearly understood. Stokes states (1) that "reinfection occurred no oftener than four times in 2,439 cases." Other authors practically agree with these findings. In this series of 506 cases reinfection was recorded 11 times. It appeared from the following interpretation only

one case was correctly diagnosed. The primary lesion of reinfection should have an interval of at least a year from his former infection, and should have had intensive treatment of his first infection. The site should not be identical in the two infections and should not even be in the same lymphatic drainage. The lesion should be darkfield positive. The chancre of reinfection is supposed to be seronegative at the onset and later become seropositive, if it becomes positive. Stokes states, in his experience with relapse, the Wassermann reaction positive, in a supposed reinfection, in less than a week is strong evidence in favor of relapse. All 10 cases called reinfection in this series had positive blood serology at the time of the infection, the lesion occurred in the same lymphatic drainage of the previous infection and most of them had only fair treatment during their first infection.

In this group of 506 cases 251 were diagnosed in the primary stage, 151 in the secondary stage, and 104 in the tertiary stage of syphilis. Of the 119 who started their treatment with negative blood serology 88 remained negative to their last examination, 26 became positive during their treatment and then negative, and 5 remained positive on their last report. Of the 506 cases 75 cases had a remaining positive blood serology on their last report. None of these Kahn fast cases had a marked change in their treatment regime like fever therapy or other methods which frequently change the serological fastness; 28 of the 506 had positive serology from the start of their treatment, throughout their treatment, and on the last report.

Ninety-two cases were carefully examined with the following program: 1. A thorough objective examination—not a “once over.”

2. The physical examination of the chest, with a special ear to the aortic second sound (tambour, systolic murmur) and cardiac and presternal dullness. The abdomen for palpable liver and spleen.

3. A search of the skin, scalp, mucous membranes, palms and soles, anus and genitalia, bones and joints.

4. A history which stresses cardiovascular and neurological symptoms and warnings and the signs of infectious recurrence: dyspnea, precordial distress, pain on exertion, hoarseness, headaches, paraesthesias, excessive nervousness, loss of memory, “nervous breakdown”, impotence, bladder retention, shooting and spotlike pains, nocturnal ataxia, sore mouth, cankers, herpes, chafes and piles.

5. Hemoglobin, blood pressure, and urine.

6. Superficial and deep reflexes, pupillary reflexes, Romberg and other neurological examinations as indicated.

7. Blood Kahn checks and the spinal fluid when possible.

Of the 92 cases examined 25 had two or more symptoms or signs of relapse; 24 of the 92 cases had one symptom or sign, such as aortic murmur, persistent unexplained occipital headache, changes in reflexes, etc. The 27 percent with clinical symptoms or signs were

multiple factors, therefore, were probably relapse characteristics. This percentage coincides with the average expected from the type of treatment they received.

"Syphilis is the relapsing disease par excellence (1)." It must also be an austere impression on the managers of syphilis control that relapse is one-fifth as important as the chancre, numerically, in the potential transmission of syphilis. Relapse tends to become malignant due to insufficient early treatment.

There were 197 case records, carefully checked, when indicated with the patient, of which 78 manifested blood serological relapses during their treatment or following their treatment. One case recorded eight relapses with an intermittent form of treatment. His serorelapses begged for spinal-fluid study or continuous intensive therapy, yet he remained on treatment only as long as his blood Kahn remained positive. He stopped his treatment when his blood Kahn became negative, using this single blood serological test as a sign of cure from his disease. This is a most frequent impression of our syphilitic patients which could be prevented if the medical officers would explain the nature of syphilis in some detail to the patient before he signs the epigram which heads the syphilitic abstract. The 92 cases examined all denied the nature of syphilis was explained to them and they merely signed because they were asked to sign.

There is a close correlation between the behavior of the serological test and the occurrence of clinical forms of relapse. Serological relapse, which means the recurrence of a positive blood serology following a negative test, occurs with about the same frequency as mucocutaneous relapse; namely 15 percent. Early serological reversal, either positive or negative, demonstrates low resistance to the disease and a tendency to serological relapse. Persistent refusal of the serological test to reverse under the effective treatment is a warning of a clinical relapsing tendency. The 39.5 percent serological relapses in this series is the expected average with treatment like the intermittent or "under-treatment" type.

The control of relapse in syphilis is mainly through early, intensive, continuous treatment. The various forms of treatment for relapse, as they occur, cannot compare with the preventive early intensive treatment, with no rest intervals, a reinforcement of the arsenicals with a heavy metal on the first course, and 75 weeks of continuous treatment in the seronegative early case and 150 weeks for the early seropositive case showing no tendency to relapse. The patient that resists these preventive measures must take the consequences of that master disease—syphilis. He must wear his infection out or be conquered by it.

Stokes, statement (1):

The actual technic of treating syphilis, vexatious and difficult as it sometimes is, can be mastered by the majority. It is quite a different matter, however, to master the general knowledge of the disease which should underlie many therapeutic decisions, so that there is a definite place in clinical syphilology for what might be called the consultant prescription, especially as applied to late syphilis.

TABLE OF TREATMENTS WITH DIFFERENT DRUGS

	Number of injections											
	Less 5	More 5	More 10	More 20	More 30	More 40	More 50	More 60	More 70	More 80	More 90	More 100
Arsenicals.....	15	24	75	114	124	72	41	25	12	9	1	1
Bismuth.....	9	28	86	91	64	50	28	16	15	7	2	3
Intramuscular mercury.....	15	33	72	54	29	17	7	2	1	1	-----	-----
Combined Hg and Bi (counting 30 rubs as 8 I. M. injections.....)	-----	3	15	25	54	45	23	22	21	8	4	9

SUMMARY AND CONCLUSIONS

1. The naval syphilitic is an excellent risk; therefore, the management of syphilis should be systematized, especially in early syphilis.

2. Early diagnosis, to assure the best chance for the syphilitic's recovery, should be improved from our apparent 23-percent efficiency to at least a 90-percent efficiency.

3. A complete neurophysical examination before or at the onset of treatment, not recorded in the 506 abstracts studied, should be carried out for future reference in the progress of this disease.

4. Prolonged, continuous, overlapping treatment with the arsenicals and heavy metals assures the best outcome; 32 percent of the 506 abstracts investigated had 50 weeks of treatment, of which only 6 (1.2 percent) of the abstracts studied occurred after 1930. It is apparent our treatment of syphilis does not conform to the modern conception of the experts.

5. Because the arsenicals were stopped with no definite reason recorded in the abstract, and, as eight of these had a negative patch test, following which they tolerated the arsenicals with proper preparation, it is well to record the exact reason and the description of the reaction in the abstract to establish a rational measure for other treatment, especially desired when there is a relapse tendency and the patient is ordered to a hospital or to another station under another medical officer's care.

6. Acetarsone has a definite place in our armamentarium for anti-syphilitic therapy.

7. The necessity for spinal-fluid examinations on all syphilitics is emphasized and briefly explained. Only 15 percent of the 506

cases had spinal-fluid examinations. The 7 positive spinal-fluid findings in 20 cases investigated suggests further study on all our case of syphilis in the Navy.

8. Ten cases of recorded reinfection in this series were found in error. They were relapses.

9. The question of relapse is briefly explained and marked with the quoted signposts of the experts; 92 cases were examined for clinical relapse; 27 percent were found to have 2 or more symptoms or signs suggestive of relapse; 26.2 percent manifested a single suggestive clinical symptom or sign; 39.5 percent of the 197 cases recorded evidence of a blood serological relapse.

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AN EVALUATION OF RECENT TRENDS IN THE MEDICAL TREATMENT OF PEPTIC ULCER

By EDGAR RICEN, Lieutenant, Medical Corps, United States Navy

Numerous theories have been advanced regarding the etiological factors involved in the genesis of peptic ulcer. Regardless of the underlying cause, the sequence of events in the pathological process has been fairly well determined. Whenever the physiological resistance of a portion of the peptic mucosa becomes diminished, due to various intrinsic or extrinsic factors that portion becomes a ready prey to the acid gastric juice and is digested in the process. Most forms of therapy in the past have attempted to create a medium which would be inducive to healing, by protecting the affected area. This has been accomplished by overcoming the hypermotility and excess acidity which is so commonly associated with peptic ulcer. The system of therapy which provides an alkaline medium and the maximum amount of rest is based on a sound physiological principle. The sippy regimen or one of its modifications has long been one of the keystones in our treatment of peptic ulcer. And yet in a certain number of cases, even though we create artificially the most favorable environment for the healing of the ulcer, healing does not take place. In fact the reverse may take place, and we find the patient steadily losing ground, despite the most rigid adherence to dietary discipline.

It is, therefore, only too obvious that until we discover that at present unknown etiological factor in the causation of peptic ulcer we can only assist in the healing process. Many of the more recent investigations in this field have been more intelligently directed. They have aimed at treating the underlying cause, as well as creating environmental conditions favorable to healing.

True, many of the results have fallen short of their goal, but the method of attack is sound and should eventually yield results.

Foci of infection have long been thought to play an important role in the causation of peptic ulcer. Rosenaw and his workers have in fact produced experimental ulcers by the injection of streptococci into the blood stream. The identical organisms with the same cultural characteristics have been reisolated from the lesions. Today most authorities believe infection to be only a contributory cause in the production of peptic ulcer, not a fundamental one.

Trippe believes that metaphen, 1:500 (an organic mercury derivative) exerts a bactericidal effect on the gastrointestinal ulcers. He bases the use of the drug on the theory that infection is one of the chief factors in the development and continuance of gastrointestinal ulcers. He reports relief from distress in the first few days, despite the fact that many of his patients have suffered for years. He also states that the great majority of his patients have had no recurrence of their gastrointestinal symptoms. In regard to diet, most of his cases having been on a sippy regimen before starting the metaphen treatment, were able to continue afterward, to quote the author, "without distress, pain or pressure." He reports no case of toxicity from the drug, although some of his patients have taken metaphen at a dosage of 16 cubic centimeters daily for months at a time. Metaphen is eliminated through the gastrointestinal tract. The average maximum tolerated dose for rabbits is about 12 cubic centimeters of metaphen 1:500, per kilogram of body weight. The method of administration of the drug as used by Trippe is as follows: Dose, 4 cubic centimeters metaphen 1:500 with 4 cubic centimeters glycerin in one-half glass of water. Gastric ulcer, one-half hour before meals. Duodenal ulcer, 2 hours after meals. Course of treatment: First week, three times daily; second week, two times daily; third week, once daily; fourth week, every other day.

The writer's experience with metaphen has not been as successful as that of Trippe. Two cases are worth citing, however. Both of these cases, after being on a strict sippy regimen for a period of 2 months, showed no improvement. In fact clinically both patients had lost ground. The pain had become more severe and there was a steady loss of weight. On metaphen 1:500 there was complete relief of pain in 3 days. Both patients gained approximately 12 pounds while on the metaphen therapy. The results obtained in

the remaining series placed on metaphen were disappointing, no improvement being noted in a series of 10 cases. These results would indicate, on the basis of the cases treated, that metaphen is of doubtful value in the therapy of peptic ulcers. The writer believes, however, that despite the fact that the use of metaphen is based on more or less of an empirical procedure, the occasional satisfactory response justifies its further trial. It is possible that in these cases in which the ulcer becomes secondarily infected, that the bactericidal action of metaphen may favorably alter the course of the disease. Certainly its trial is justified, when no relief is obtained from a strict adherence to a sippy regimen.

There has been a growing conviction during recent years that gastro-duodenal ulcers are due to a trophic disturbance, involving the innervation of the stomach. Certain it is that there are those individuals who indulge in all sorts of dietary indiscretions and alcoholic excesses without developing peptic ulcer. Probably this factor is only contributory and not a basic one.

Evidence is gradually accumulating which would tend to indicate that peptic ulcer is definitely associated with certain anxiety states. Ulcer is more prone to develop during times of stress and strain, fatigue and worry. Todd has shown in his studies on medical students that hypermotility always accompanies states of mental distress. Continual hypermotility, pylorospasm, and retention result in an increased free and total acidity of the stomach contents. Such a medium, if continued over a long period of time, might be the first step in the production of ulcer. It has been shown that mental distress results in stimulation of the splanchnic nerves. The continued vasoconstrictor action, resulting from the stimulation of the splanchnics, probably renders the peptic mucosa a more ready prey to the acid gastric juices. The literature contains many examples which support the neurogenic theory of the genesis of ulcer. Stimulation, paralysis, and section of the vagus produces ulcer in rabbits. Brain lesions in man and animals have also been accompanied by acute ulcers of the gastro-intestinal tract.

On this basis, that the genesis of peptic ulcer is due primarily to a trophic disturbance, the injection of nonspecific foreign protein, typhoid vaccine, and milk protein have been tried by some investigators. Many of these (Martin, Hurst, Carlson) report beneficial results. Weiss and Aron have found that intramuscular injections of histidine are effective in stimulating the growth of the gastro-intestinal mucosa. Blum and Lenormand also report apparent success in the relief of ulcer symptoms from the use of histidine. They report the relief of ulcer pain after four to five injections, clinical and radiological cure following in a few weeks. The actual mechanism of this treatment has not as yet been fully determined by these

investigators. Among the explanations offered are that histidine provides an essential substance which is lacking in the dead mucosal cells. Another, that histidine is thought to be necessary for the maintenance and repair of the mucosal tissue. When the mucosal cells become deficient in histidine, the peptic mucosa becomes more susceptible to the action of the acid gastric juice.

One of the histidine derivatives on the market today is presented as larostidin. It consists of a 4-percent solution of histidine hydrochloride, prepared in 5 cubic centimeters ampules for subcutaneous or intramuscular injections. The treatment recommended by the makers consists of the daily administration of 5 cubic centimeters and is continued for 24 days.

The writer's own experience with this histidine derivative does not coincide with the claims of the makers, namely: "Prompt relief of symptoms without recurrence is the keystone of larostidin medication." In none of the cases studied did "prompt relief without recurrence" result. From our own experience the results do not justify the inconvenience and expense incidental to carrying out the course of treatment. More experimental work must be done with the histidine derivatives and better results obtained before the medical profession is justified in recommending its general use for the treatment and cure of gastro-duodenal ulcers.

Another form of nonspecific foreign protein therapy available is a combination of lipo proteins with emetine. It is prepared under the name of synodal. The claims of the makers are not as extravagant as those offering the histidine derivative. It is our experience that this preparation is not without value. In a series of 10 cases, pain was relieved in 7. In four (of these seven) there was later a return of symptoms but further administration of the drug again brought relief. The makers recommend the intravenous or intramuscular methods of administration. An injection of 6 cubic centimeters (an ampule) is given twice a week or every third day. After the sixth dose, the interval between injections is extended to 1 week. The maximum number of injections for 1 course is 10. Six to eight weeks should intervene before a second course is administered.

A variety of theories have been put forth explaining the modus operandi of the drug. It is supposed to diminish gastric contractions, thus relieving the pain of hunger contractions. It is also claimed to relieve pylorospasm. Others attribute healing due to the increased vascularity about the ulcerated area, as a result of the nonspecific protein therapy.

Emetine accumulates in the gastrointestinal mucosa following intravenous administration. Some investigators (Vidder, Frazier, Wherry) believe that in weak dilutions it exerts a bactericidal effect against a variety of micro-organisms.

As is often the case, the greater the number of explanations, probably the less reliability can be placed in any one of them. At present the drug can be used only on more or less of an empirical basis. The true mechanism for its action will have to come later if at all. This is not necessarily an argument against its use. The history of medicine contains several instances of drugs which were first successfully used on a purely empirical basis, before the true mechanism of their action was thoroughly understood.

In our opinion synodal justifies its use as a therapeutic agent in the treatment of gastro-duodenal ulcer. There is no question but that relief of pain and clinical improvement has resulted in about 70 percent of the cases under our observation. True, about 30 percent did not respond to treatment, but it is also true in our experience that approximately a similar percentage did not respond to a sippy regimen.

Another therapeutic agent available in the treatment of gastro-duodenal ulcer is mucin. Ivy and Fogelson first suggested its use in the treatment of peptic ulcers. They believed it to act by forming a protective coating over the ulcer, in this manner protecting it from the action of the acid gastric juice. Bloch and Rosenberg have given mucin an extensive clinical trial. Their results are disappointing as far as the value of mucin as a new therapeutic principle is concerned. They bring out the fact that the diet recommended by Fogelson in combination with the mucin treatment (puréed fruits and vegetables) will alone bring about a remission of symptoms. In some of their cases they report the patients grew worse on the treatment, many of their symptoms being exaggerated following the use of mucin.

As a result of their studies they drew the following conclusions: Many patients will not continue on mucin because of its extremely disagreeable taste. In many cases no relief is offered; in fact the reverse may result. In some, relief is only temporary. A certain number respond to mucin therapy. They believe it acts through its demulcent or protective action rather than by its acid-combining power. Further research in its preparation and use will be necessary before it can be generally accepted as a valuable therapeutic agent in the treatment of peptic ulcers.

Roentgen rays offer another method of attacking the problem of peptic ulcer. The literature reports cases of apparent cure, following deep roentgen-ray therapy of duodenal ulcer. Most writers agree that the margin of safety in its use is too slight to warrant its continued use. Due to the proximity of the pancreas, the possibility of grave pancreatic damage precludes its use as a safe therapeutic agent.

Before concluding, the writer believes a word should be said about the present status of the alkali and dietetic treatment of peptic ulcer.

It has been the writer's experience that approximately 70 percent of all peptic ulcers respond to a sippy regimen or one of its modifications. One should, however, not lose sight of the fact that the peptic ulcer is a local manifestation of an underlying metabolic unbalance. By creating a favorable environment we may assist the healing process but not remedy the causative factor. The physician should constantly be on the alert to ascertain the underlying cause and correct it if he can, in order to insure a cure and lessen the probability of a remission.

The writer is most enthusiastic about the method of controlling hyperacidity as used by Winkelstein. A rehfus tube is used. After the tube is swallowed, it is connected by a piece of rubber tubing to a gravity flask and a murphy drip indicator. A solution consisting of milk with 5 grams of sodium bicarbonate to the quart is allowed to drip into the stomach at the rate of 30 drops a minute. The patient receives 3 quarts of milk and 15 grams of bicarbonate of soda in 24 hours. This solution will neutralize 9 quarts of N/10 hydrochloric acid. Numerous samples aspirated, showed a complete absence of hydrochloric acid and a low total acidity. Winkelstein recommends the following as adjuvants to the treatment:

1. Accustom the patients to the tube before starting the treatment.
2. After 48 hours of treatment estimate the alkali reserve of the blood (carbon dioxide combining power). If this nears 80 volumes percent, or if symptoms of alkalosis appear, the amount of alkali should be diminished. Winkelstein reports no cases of alkalosis. In our own series no evidence of alkalosis was observed.
3. He recommends the use of sedatives, especially if the patient has neurotic tendencies.
4. For excessive dryness of the throat an occasional swallow of the mixture can be taken.

As an adjuvant to this treatment he recommends heat to the abdomen and atropine 1/75 to 1/150 T. I. D.

The milk should approximate room temperature and is given continuously throughout the day and night. He also emphasizes removal of all food or food odors to prevent psychic stimulation. At the end of 2 or 3 weeks the tube is removed during the day only. At 8 p. m. the drip is started and continued until 8 a. m. During the day alkali and milk are administered every 2 hours. The tube can be withdrawn permanently, as soon as clinical and radiological improvement warrants it. Follow-up treatment is of course important and should be carried out in the usual manner.

The writer has found the results obtained from this treatment most gratifying. Complete relief of pain usually resulting within a few hours (4-6) after the milk drip therapy has been instituted. Most

patients tolerate the tube remarkably well. After experiencing the rapid relief afforded, the patient is most willing to cooperate with the physician. This treatment has been continued for 4 weeks without any untoward results. We believe that the milk drip therapy as advocated by Winkelstein is the most effective medical treatment of gastro-duodenal ulcer.

CONCLUSIONS

1. Alkali and dietetic treatment offered relief in approximately 70 percent of the cases under observation. The milk drip therapy as advocated by Winkelstein was found to be a most effective measure in the alkali and dietetic management of peptic ulcer.

2. Approximately 30 percent of the cases under observation remained refractory to the use of alkali and milk therapy. Some of these cases, in fact, grew steadily worse on this treatment.

3. There is some evidence accumulating to prove that nonspecific protein shock therapy yields favorable results in gastro-duodenal ulcer. In our series the lipo proteins were found the most effective. We obtained almost the same results (70 percent responding favorably) as with milk and alkali therapy. The histidine derivatives were found to be of no value in the cases under our observation.

4. From our results, mucin is of little value in the treatment of gastro-duodenal ulcer. Further research in its preparation and use will be necessary before it can be accepted as a definite advance in ulcer therapy.

5. The occasional marked success obtained from the use of metaphen would tend to indicate that it is of some value. It apparently yields the best results in those cases in which the ulcer has become secondarily infected. These results would indicate the bactericidal action of metaphen may favorably alter the course of the disease in certain selected cases.

6. The danger of severe pancreatic damage at present precludes the use of deep roentgen-ray therapy for general use in the treatment of peptic ulcer. Further perfections in the technique of administration in the future may admit its use with safety.

7. Peptic ulcer should be looked upon as a local manifestation of an underlying constitutional disorder. The physician should not be satisfied with treating the ulcer as such, in order to hasten a cure and prevent recurrences, he must try to discover and remove the underlying cause. Local treatment, unfortunately, can only assist. An open mind should be kept at all times, as it is becoming only too apparent that the last word in ulcer therapy has not yet been written. Although some of the procedures outlined above may appear unscientific and empirical, yet some of them do yield results. Here it might be well to emphasize that we are not treating an ulcer but an individual.

Different individuals may respond to different forms of therapy. It is this problem which the physician must solve. In justice to the patient he should attempt all methods of approach regardless of any preconceived prejudices.

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CLINICAL NOTES

THE PHYSICIAN'S CHANCER

By BARTLETT C. SHACKFORD, Lieutenant Commander, Medical Corps, United States Naval Reserve, Long Beach, Calif.

In spite of the fact that medical teachers and writers have emphatically stated that any digital lesion, no matter how insignificant in appearance, should be carefully examined for evidence of syphilis, there are few lesions more often erroneously diagnosed than chancre of the finger. Frequently, when there is no erosion or ulceration, they are considered to be paronychias. The granulating varieties have been diagnosed sarcoma, and treated by amputation. Some have been called felons, and subjected to drainage. Others have been treated with radiation because of a supposed ringworm infection.

Many physicians have been misled because of having been taught that chancres are not painful, although it is not at all uncommon for digital chancres to produce intense and lasting pain. Others fail to think of syphilis because of a preconceived idea of chancre morphology. It is important to know that such primary lesions may exist without any apparent local reaction; that they may result in the formation of a large, exuberant, sarcoma-like growth; or that almost any type of purulent or ulcerating sore may be found. If kept in mind, the diagnosis should rarely be missed, because of the frequency with which the organisms may be found by dark-field examination, which should never be omitted, no matter how old the lesion may be.

The following case serves to emphasize the truth of the old adage that a diagnosis of which one does not think is a diagnosis which cannot be made.

Case 22505.—A middle-aged urologist was referred for examination of a lesion of the left index finger, which had been present about a month. He stated that for months his nails had been thin, with longitudinal ridging. Four months ago, while lowering the baggage compartment cover of his coupe, his left index finger was injured near the nail, leaving it rough.

On January 13, 1937, while in bed convalescing from influenza, he noticed that his left index finger had become acutely tender and was swollen along the inner border of the nail. He consulted a colleague who treated it with hot boric-alcohol soaks until January 18. On January 17 and 18 he had a severe backache. Another consultant on January 18, excised a portion of the nail along its right border, and drained the apparent paronychia. The nail was found to be loosely adherent to its bed. In spite of continued boric-alcohol soaks, the finger remained very tender along the line of incision, the entire

nail bed became red and inflamed, the rest of the nail was removed on January 23, and a vaseline dressing was applied. Because the consultant's technician thought she found ringworm spores and a single mycelial thread on culture, Berwick's solution of methyl violet and methylene blue was applied daily from January 25 to 30, with no benefit. Weak aluminum acetate solution was then used, without relief. The lesion was then dried, and one-fourth of a skin dose of X-ray was given, but there was no improvement, the lesion remaining a sloughing sore, with one small ulcer in the middle of the nail bed, which was the only open lesion ever found. There was some swelling, but no induration. The left epitrochlear node was slightly enlarged.

On February 9 lues was seriously considered for the first time, and he was sent to us for dark-field examination. The finger tip was now deeply stained with Berwick's solution; the ulcer in the middle of the nail bed, which was 3 millimeters in diameter, was dry, shallow, and concave, and there was a small crack in the skin at the base of the nail bed. Slight pressure in this region brought forth a small amount of thick, purulent fluid, dark-field examination of which revealed enormous numbers of active spirochetes, which in morphology and motility were typical *spirochaeta pallida*.

Examination of the patient did not disclose evidence of secondary lues. The Kolmer quantitative test and Kahn test taken at this time were negative.

On February 9 and 10 the patient's physician gave him 0.15 gram of neoarsphenamine, and applied calomel ointment to the lesion, which produced intense local burning pain. Kolmer test and Kahn tests were taken February 12. They were negative. On February 12 he received 0.2 gram of neo, and went to San Francisco for consultation with a specialist, who concurred in the diagnosis of chancre. Because of the patient's fear of an arsenical dermatitis, he continued to take neo in small doses, receiving 0.3 gram on February 17, supplemented with 2 cubic centimeters of iodobismuthol on February 14 and 17. On February 19 he returned to us for another dark-field examination, which disclosed as many as 100 *spirochaeta pallida* per field. Negative Kolmer and Kahn tests were obtained at this time. February 20 he took 2 cubic centimeters of iodobismuthol and 0.45 gram of neo and applied a solution of the latter to the lesion, producing intense local pain, which lasted for hours in spite of much codeine. By February 22, when he received 2 cubic centimeters of iodobismuthol and 0.5 gram of neo, there was some evidence of healing, and on February 26 the finger was almost free of pain for the first time since the sore appeared. In spite of continued treatment, on March 1 the finger became sore on the side opposite the crack from which material was obtained for the first dark-field examination, and a small ulcer was found under the scab of the nail bed. A dark field from this region showed a great many spirochaetes, most of which were nonmotile, the rest being sluggish. The patient was not seen again by me until March 25, when he came to report that he had been taking 2 cubic centimeters of iodobismuthol twice a week and 0.5 gram of neo every 5 days. The finger had completely healed by March 10. Kolmer and Kahn tests on March 25 were negative.

EXTRAGENITAL CHANCER

REPORT OF CASE WITH UNUSUAL LOCATION

By C. W. STELLE, Lieutenant, Medical Corps, United States Navy

Syphilis distinguishes itself in several ways. The great majority of cases run a definite course, are readily diagnosed by physical ex-

amination of the primary penile lesion, the dark-field examination, the blood Kahn test, and other well-known physical signs. Other cases first come to the attention of the medical officer when a positive blood Kahn test is discovered in a patient during routine examinations. By careful questioning the patient may admit that he had a small penile lesion which healed quickly and which he did not think of sufficient importance to report. Careful physical examination may also reveal the presence of the primary lesion in some location other than the genital organs.

The successful treatment of primary syphilis depends on the early recognition of the chancre. The differentiation between the so-called hard and soft chancre should not be relied on and the first step is therefore examination of serum from the sore by means of the dark-field. This test, when positive, confirms the diagnosis of syphilis.

One, too often, neglects to give sufficient time and thought to "sores", "pimples", and ulcers that develop elsewhere than on the genital organs. By far, most cases of extragenital chancres occur on the lips and adjacent area. Other locations include the skin of the symphysis pubis and the hands. It is a well-known fact that primary chancres have occurred on hands of physicians who conduct examinations and do autopsies on syphilitics.

The following case of extragenital chancre is reported because of the unusual location, and because of the fact that a positive dark-field examination was made even after the "ulcer" had been treated with various solutions and ointments.

CASE REPORT

E. F. V. sea. 2c., reported at sick call on September 25, 1935, complaining of a small sore on the skin of abdomen. He stated that he first noted this sore on September 7, 1935, and that it had the appearance of an ordinary pimple, so he did not think it important. Examination revealed a small rounded slightly punched out painless ulcer of the skin on the right side of the abdomen, located about midway above a line drawn from the umbilicus to the right anterior crest of the ileum. The usual treatment for simple ulcers and furuncles did not promote healing and the lesion continued to enlarge. It was not painful.

By October 7, 1935, the lesion had enlarged considerably and measured 2.5 by 2 centimeters in its greatest diameter. The lesion also had the appearance of a typical chancre. It was cleaned with saline compresses and a dark-field examination done, which was positive. This was obtained 13 days after he first reported to sick bay. A blood Kahn test, also done on October 7, 1935, was reported 4 plus.

Further examination failed to reveal any lesion on the genital organs. The inguinal and epitrochlear lymph nodes were moderately enlarged. On further questioning the patient stated that his last exposure to venereal disease occurred about July 20, 1935, approximately 49 days prior to appearance of the "pimple" on his abdomen. He persisted in the truth of this last statement.

Antiluetic treatment was instituted and the lesion promptly healed.

Therefore medical officers should always bear in mind the possibility of extragenital chancres when conducting examinations. Occasionally one finds a "cold sore" on the lip or in the mouth, a "pimple" on the face or skin of the trunk, or an ulcer that doesn't heal as the ordinary pimples, cold sores, or ulcers should. Several weeks may be lost before Kahn tests and dark-field examinations are resorted to and the diagnosis established.

**GONORRHEAL OPHTHALMIA—REPORT OF A CASE TREATED BY
HYPERTHERMIA**

By JACK TERRY, Commander, Medical Corps, United States Navy

Previous experience in the treatment of acute gonococcus infection and its complications in the female by hyperthermia encouraged the writer to try hyperthermia in gonorrheal ophthalmia. For some time acute gonococcus infections have been cultured in test tubes and typed as to their resistance to heat of certain temperatures for a given period of time. The information ascertained in this manner was used in treating the individual case. Gonococcus infection of the conjunctiva has for years been an infection which the medical profession has been helpless to treat with its usual chemicals and irrigations. The treatment seems to have resolved itself into excellent nursing care. This, however, has been insufficient to prevent ulcer and blindness.

Hyperthermia, in which a temperature of about 107° F. is maintained for several hours, will probably be looked upon as a specific in that normal physiology is forcibly restored. The diplococci are killed within a period of 4 hours at the proper temperature. The destruction of the causative organisms accompanied by active dehydration decreases the number of polymorphonuclear cells which come from the epithelial infection and of course a markedly decrease in the purulent discharge. There is also a decrease in chemosis, hyperemia, and edema of the lids. It is suggested that a culture be taken at the time of diagnosis and the organisms typed as to their heat-resisting power and the time it takes such heat to kill the organisms. In this way statistical information of this kind will help scientifically in the time the patient is exposed to treatment. These cultures and routine tests will also assist in explaining failures with this technique.

Mrs. D. E., American housewife, age 18 years presented herself complaining of an acute inflammation of her left eye which caused burning pain and produced a heavy purulent discharge. The patient stated that on the previous afternoon she assisted in nursing care of a sick lady friend who later proved to have an acute gonococcus infection. Later she rescued her kitten from a tree and some

bark fell in her eye which condition seemed to be entirely relieved when she rubbed it. In 4 or 5 hours the eye began to lacrimate and pain her. She bathed the eye a number of times during the night with hot boric solution. The patient presented herself early next morning for relief and she was admitted in the isolation ward. A watch-glass patch was placed over right eye. A smear taken from left eye showed numerous pus cells and many intra- and extra-cellular gram negative diplococci and the case was reported as gonococcus infection of conjunctiva. Her cervical smear was negative for gram negative intra- and extra-cellular diplococci. Special nurses were assigned and the following orders were carried out, every 20 minutes for a period of 48 hours, without any physical or bacteriological change in the pathology of the eye. The treatment consisted in alternating hot and cold boric compresses followed by instillations of 10 percent silvol solution. The pupil was dilated by 2 drops of 2 percent atropin solution twice daily.

At 10:20 a. m., 48 hours after admittance, the patient was placed in the dry hyperthermic heat box. Routine medical care was given, morphine one-eighth per hypo as often as necessary and nembutal capsules by mouth. The routine treatment of the eye was done at irregular times for the reason that medical care and irrigation of the eye could not be done by one nurse. At 12 noon the temperature had reached 106° F. The discharge had decreased to a noticeable degree. At 1 p. m. the conjunctiva was cocanized and temperature taken in upper and lower lids revealing temperature of 106.4° F. At 1:30 p. m. the temperature was increased to 107°. At 3:30 p. m. the temperature was 106.5° and there was practically no drainage, a marked loss of chemosis and edema of the lids. The nurses reported the eyeball as dry and bluish in color. At 4:20 p. m. the heat was turned off and the patient returned to her bed in the isolation ward. At 5:20 p. m. atrophine medication was continued and previous eye routine was done every hour. The discharge from the eye was thin and slight in amount. The following morning the smear showed no introcellular organisms and only a few pus cells with a few extra-cellular gram negative diplococci persisting. Three days after the smear showed a few pus cells and no organisms. The patient had patch from right eye removed and was discharged to home. Eleven days after discharge vision in the eye was charted as normal and no defects noted. The patient stated that occasionally she had a dull neuralgiclike pain in the eyeball and brow.

CANCER OF THE PENIS

By WILLARD S. SARGENT, Lieutenant Commander, Medical Corps, United States Navy

Chronic irritation, is still given first place among the possible causes of carcinoma and such things as phimosis, venereal warts, scars, and chronic balanoposthitis as well as chancre, chancroid, gonorrhea, or other inflammatory affections furnish the predisposing cause. Those having been circumcised, rarely have penile malignancy. Contact cancer is doubtful. The lesion usually begins on the glans or prepuce, and starts as a warty growth, which if cut off recurs, grows again in a cauliflowerlike manner and ulcerates, giving off a foul discharge. The ulcer base is hard and everted, and may bleed or cause stricture and may rarely give pain, the latter like cachexia being a

late symptom. The inguinal glands are involved late so the prognosis is fairly good until then and even after involvement the patient may not be surely doomed, but all advanced cases die and strangely enough most cases are not seen until late in spite of the fact that early diagnosis and treatment is so imperative.

Cancer is almost the only condition calling for amputation of the penis. Some advocate only circumcision, if the growth is early, not indurated and localized on the prepuce. Others feel that a similar condition on the glans, only, needs cauterization. For leucoplakia the cautery or excision is enough. If induration is present amputation, with removal of the superficial and deep inguinal glands of both sides is indicated, yet if the iliac glands are involved surgery is useless. When the growth does not extend further back than 1 inch from the corona partial amputation will usually suffice.

CASE REPORT

History.—An adult male, of Guam, aged 52, was admitted, complaining of pain and swelling of the penis together with phimosis. He had gonorrhea 12 years before and feared this was a recurrence, so delayed seeking advice. Four months before, he noted some swelling, induration, and finally inflammatory symptoms, with a discharge from the area under his foreskin which grew worse and became painful.

Examination.—The physical examination was negative, except for bilateral slightly enlarged inguinal glands, more so on the right, and the penis which showed an inflamed prepuce, that could not be retracted and from under which a foul discharge exuded. The induration and hardness did not extend back of the corona. Chancre was ruled out by the cauliflowerlike growth and a negative Kahn. The growth and the lack of ulcers (except of the growth) spoke against chancroid and ulcerative balanoposthitis. Simple warts do not ulcerate or infiltrate. Condylomata and granuloma inguinale do not infiltrate.

Treatment.—After admission a dorsal slit was done which showed a cauliflowerlike growth about the size of a dime on the right side of the corona; it was ulcerated and some balanoposthitis was present. After a few days treatment for the inflammatory condition, amputation of the penis, with removal of the glands in both groins, was done under spinal anaesthesia. The skin was divided circularly about the center of the shaft and a cuff about one-half inch long was turned back. The corpora cavernosa were divided transversely at the end of the reflected cuff and the urethra was divided about one-fourth inch distal to the cut in the cavernosa. The dorsal artery and vein and the vessels of the cavernosa were ligated and the fibrous walls of the corpora cavernosa were sutured in the median line. The urethra was split anteriorly and posteriorly for a short distance and when the skin was sutured in the median line the urethra was anchored in the lower end.

No radium or X-ray therapy was available so postoperative irradiation was not done. A catheter was placed and retained in the urethra for 5 days and the bladder was irrigated twice daily. Complete healing occurred. Microscopy proved the growth to be carcinoma. Two years after the operation he was reported to be alive and without recurrence.

TRICHINOSIS**A REPORT OF TWO CASES**

By MAURICE JONES, Lieutenant Commander, Medical Corps, United States Navy, and
JOHN J. WELLS, Lieutenant (Junior Grade), Medical Corps, United States Navy

The importance of signs and symptoms in the diagnosis of disease is the frequency with which they occur in one disease and their absence in other diseases. This fact was very well illustrated recently on board the U. S. S. *Dobbin*, when two cases were admitted to the sick list during a mild outbreak of influenza. Case 1 was carried under the diagnosis of influenza for several days. The patient presented edema of the eye lids, muscular pains and fever. Routine examination of the blood showed a neutrophilic leucocytosis which was regarded as unusual for influenza. When edema of the eye lids and muscular pains were accompanied by a remittent fever, trichinosis was suspected and on the third day of the disease, after repeated examinations of the blood, an eosinophilia was found. Case 2 complained of muscular pains and puffiness of the eye lids and on examination of the blood an eosinophilia was also found.

In reporting these two cases of trichinosis it is not the intention of the writers to add anything new to this very interesting disease. The literature is briefly reviewed and emphasis is placed on the frequency with which it occurs and important points in its diagnosis are discussed, including the more recent skin and precipitin tests which are routinely used in the large clinics and hospitals and which have largely replaced the muscle biopsy in the diagnosis of the disease.

The annual report of the Surgeon General of the United States Navy for the years 1933, 1934, and 1935 showed no admission for trichinosis. However, it should not be inferred that this is a rare or uncommon disease. On the contrary, it is a relatively frequent disease which occurs in small family outbreaks or in a mild sporadic form. Many cases are undoubtedly of such a mild nature that medical attention is not sought or the attending physician, because of the mildness of the case, may overlook the true condition. The reports of the United States Public Health Service show that 582 cases were reported by various States during the year 1935, and 318 cases in 1936.

In several reported series of routine necropsies in which a search for trichinella spiralis was made in the diaphragms of cadavers after artificial digestion, it was found that the incidence varied from 17 percent to as high as 27 percent. Queens' series of 344 cases in Rochester, N. Y., showed 59 positive for trichinella spiralis, an incidence of 17.5 percent. It is of interest to note that in not a single

one of these 59 cases had an ante-mortem diagnosis of trichinosis been made.

CASE 1

C. S., printer, 1c., United States Navy, age 30 years. Reported at morning sick call on December 30, 1936, complaining of backache and dizziness of 24 hours' duration.

Present illness.—On December 29, 1936, he developed a feeling of warmth associated with chills, dizziness, and general malaise. The following morning his eyelids were markedly swollen. All the muscles of his body were tender and painful on motion, particularly the small of the back, which pain radiated down both legs as far as the calf muscles. There was a vague feeling of epigastric distress and he had one profuse, watery, bowel movement. He stated that he felt weak and any movement required a great deal of effort. His appetite was capricious. He complained of a severe frontal headache with a sensation of pounding and throbbing. His eyelids smarted and his eyes were sensitive to light.

Past history.—Noncontributory to present illness.

Physical examination.—Height 64 inches, weight 154, temperature 103.2°, pulse 94, respiration 20. A well-developed, nourished, young adult male, lying flat in bed, in moderate discomfort. Only significant physical findings are reported.

Eyes.—There is a moderately severe edema of the upper and lower lids and conjunctival chemosis with photophobia and lacrimation. Eyeballs are normal in range of motion but are moderately painful.

Throat.—Moderate injection of faucial pillars.

Tongue.—Protrudes in midline with slight tremor, moderately furred.

Neck.—There is a moderate tenderness on palpation of posterior neck muscles.

Chest.—Scattered throughout both lung fields are inconstant musical rales.

Abdomen.—No tympanites, masses, or tenderness.

Reflexes.—Normal.

Spine.—There is tenderness on palpation and percussion over the lumbo sacro-iliac joint area with mild spasm of overlying muscles. Range of motion of spine normal but painful with radiation of pain down the leg along the course of the sciatic nerve.

Extremities.—Upper, normal; lower, there is moderate tenderness on palpation of posterior thigh and calf muscles; all motions are performed with moderate difficulty.

Urine.—Specific gravity 1.020, reaction acid, albumin one plus, sugar negative, no casts, no red or white blood cells.

White blood cells.—13,400. Bands 8, segmented 82, lymphs 10.

Treatment.—Magnesium sulphate 1 ounce stat., fluids forced, semisolid diet, bed patient, aspirin grains X for pain P. R. N.

December 31, 1936.—Temperature 101.2, pulse 84, respiration 20; complains of a severe persistent headache; during the past 12 hours has had chills and fever; there is a generalized soreness of all the muscles of the body.

White blood cells.—10,600. Bands 2, segmented 78, monos 2, lymphs 18.

January 4, 1937.—Temperature 101.6°, there is a remittent fever with an evening rise to as high as 103°, pulse remains below 100, the general muscular tenderness and pain persists.

Examination of stools and urine negative for parasites.

White blood cells.—13,000. Bands 10, segmented 35, eosinophils 32, lymphs 18, monos 2.

January 5, 1937.—Condition slightly improved.

White blood cells.—10,600. Bands 12, segmented 27, eosinophils 35, lymphs 20, monos 4.

January 6, 1937.—In view of the history of the muscular pains, edema of the eyelids, a remittent fever, and an eosinophilia, trichinosis is suspected. Further questioning reveals that about 5 days prior to the onset of his present illness, the patient ate some pork sausage meat which he bought and cooked himself. He states that it was not cooked well. Biopsy obtained from left deltoid muscle with 1 percent novocaine as an anesthetic. Specimen teased and examined under high dry power of microscope. No T. S. L. found.

January 7, 1937.—Biopsy under 1 percent local novocaine anesthesia repeated using left gastrocnemius. Specimen sent to United States Naval Hospital, San Diego, Calif., for sectioning.

January 9, 1937.—Temperature rise to 99.8°, fall by lysis, general condition markedly improved.

White blood cells.—11,300. Eosinophilia 20 percent.

January 12, 1937.—Report from laboratory reveals T. S. L. present in muscle. Temperature 98.6°, allowed up gradually, no complaints.

January 20, 1937.—To light duty under treatment.

February 14, 1937.—Blood specimen obtained and serum forwarded to United States Naval Medical School for precipitin test. Reported positive (titre 1:1600).

February 17, 1937.—Trichinosis antigen obtained from the George Williams Hooper Foundation, San Francisco, Calif., and skin and precipitin tests were done. Skin test positive; precipitin test positive.

CASE 2

J. T., a 30-year-old blacksmith, 1c., was admitted to the sick bay on January 3, 1937, complaining of generalized weakness and muscular pains of 5 days' duration.

Present illness.—The patient stated that on or about January 10, 1937, he developed a watery diarrhoea with mild abdominal pains and a vague feeling of nausea. He did not vomit. There was no blood in the stools. This lasted for about 24 hours. On January 12, 1937, on rising in the morning he noticed a puffiness of his eyelids. In the evening he felt feverish and perspired freely. He passed several watery bowel movements. He then began to notice a soreness and pain on motion in the muscles of his thighs, calves, right shoulder, and along the axillary border of his left chest.

On January 13, 1937, because of a persistence of a muscle soreness and a general feeling of weakness he reported to the sick bay. Further questioning elicited a history of the ingestion of cooked pork sausage.

Physical examination.—Temperature 98.6°, pulse 80, respiration 20, a well-developed and nourished male adult, somewhat pale in appearance. Only significant physical findings are reported.

Eyes.—There is a moderate edema of the upper and lower eyelids with a mild chemosis.

Reflexes.—Equal and active.

Extremities.—Upper, range of motion normal, on the right side there is mild soreness on palpation of the right deltoid and trapezius muscle, and mild pain on motion. Lower, contour and range of motion normal. On palpation of the thigh and calf muscles there is a slight degree of soreness and pain on motion.

Urine.—Specific gravity 1.020, reaction acid, albumin, sugar, and microscopic negative.

White blood cells.—6,800. Bands 2, segmented 47, monos 4, eosinophils 13, lymphs 34.

January 8, 1937.—Temperature rise to 100°, pulse 74, muscular soreness subsiding, treatment has consisted of vigorous catharsis, regular diet, and bed rest.

White blood cells.—9,400. Segmented 57, monos 14, lymphs 23, bands 4, eosinophils 2.

January 9, 1937.—Biopsy, 1 percent novocaine anesthesia, right gastrocnemius muscle, a piece of specimen teased and examined under high dry power of microscope. No T. S. L. found. Specimen forwarded to United States Naval Hospital, San Diego, Calif., for sectioning.

January 21, 1937.—Report from laboratory negative for T. S. L. White blood cells show a 6 percent eosinophilia.

January 23, 1937.—To duty under treatment.

February 14, 1937.—Blood obtained and serum forwarded to United States Naval Medical School for precipitin test. Reported negative.

February 17, 1937.—Skin and precipitin tests were done using the same antigen as in case 1. Skin test, mildly positive; precipitin test, doubtful.

The history and findings in this case leaves no doubt as to the accuracy of the diagnosis although muscle biopsy and precipitin tests were negative and the skin test only mildly positive. This patient had a very mild infection, but the eosinophilia, edema of the eyelids, muscle pains, and a mildly positive skin test could be explained in no other way except by infection with the *trichinella spiralis*.

The common source of infection for man is the ingestion of insufficiently cooked pork or pork products. Other animals harbor the parasites, as was shown by an outbreak in a family in California who had eaten improperly prepared bear meat. Rats are known to harbor the parasites, and it was formerly believed that they were the usual source of infection for the pigs. More recent observations indicate that this is not the case. The porcine infection is apparently obtained by the eating of pork scraps and offal from the slaughter house, the rats obtaining their infection in a like manner and passing it from rat to rat by their cannibalistic habits, but not from rat to pig.

The symptomatology of the usual case of trichinosis is extremely variable both as to nature of the symptoms and their severity. Gastro-intestinal symptoms are usually present but they may be absent. When present they consist of nausea, vomiting, vague epigastric distress, and mild diarrhea. Headache and anorexia are common complaints. Fever is present and may be marked; it is of the remittent type and falls by lysis. General muscular pains and soreness are common. Chemosis and small subconjunctival hemorrhages are frequent. Edema of the eyelids is very common and was a prominent symptom in the two cases reported. The most characteristic finding is an eosinophilia which is rarely absent sometime during the infection. It must be remembered, however, that repeated blood examinations are necessary, as the eosinophilia may not appear early

in the infection or it may be suppressed by a secondary pyogenic infection but will reappear when the secondary infection is cleared up.

In the past, proof of the accuracy of the diagnosis has rested on muscle biopsy. A small piece of the deltoid or gastrocnemius muscle is removed and gently teased with a pair of needles in a drop of glycerine and examined under the high dry power. If the characteristic *trichinella spiralis* are found, no further proof is necessary, but repeated biopsies have been done on many cases with negative results. A muscle biopsy is at its best an inconvenience to the patient and it may now be supplanted by the newer skin and precipitin tests which may be done with ease and the results of which may be considered as accurate.

A positive skin reaction appears usually during the second or third week of the infection and has been observed as long as 7 years after the infection. Certain normal individuals have been reported as giving a positive reaction but it is quite possible that these reactions were due to a previously unrecognized trichinosis. False positive reactions have been reported in patients who had previously received quinine treatment for malaria or arsenic for syphilis.

The antigen used in these two cases was obtained from the George Williams Hooper Foundation as was the Coca's solution (NaCl 0.5 percent; NaHCO_3 0.05 percent; phenol 0.4 percent) used as the diluent. An injection of 0.1 cubic centimeter of a 1-10,000 solution is made intradermally in the forearm and a like amount of the diluent is injected in the other arm and used as a control. The test is first read in 5 minutes when a positive reaction appears as a blanched wheal surrounded by a well-marked erythema. The reaction will obtain its maximum size in less than an hour and will have entirely disappeared in 24 hours. It is of importance to remember that the proper dilution of the antigen must be used and the reaction read promptly.

The precipitin test is performed by overlaying 0.5 cubic centimeter of the serum with an equal amount of a 1-100 dilution of the antigen. A control is run at the same time using the diluent of the antigen. The tubes are placed in a water bath at 37.5°C . for 1 hour, at which time a positive reaction will show a white ring at the junction of the serum and the antigen.

Reports have appeared from time to time of the finding of the parasites in the blood, spinal fluid, and stools, but from a practical standpoint any such search for the parasites for proof of the diagnosis may be disregarded.

The treatment at the present time is very simple and is that of any febrile disease. After a preliminary purge the patient is kept in bed and insured comfort and sleep by any of the ordinary an-

algescics and hypnotics. A simple but adequate diet is given. Attempts have been made to destroy the parasites in large numbers in the body by the use of an assortment of drugs which need not be mentioned as no definite results have been obtained. Calcium and vitamin D to accelerate calcification may be considered of possible value and at least harmless. To date, antitoxic sera have been of no value in damaging the parasites but may prove to be of value in combating the toxæmia.

In the prevention of the disease it is of importance that supervision of slaughter houses be exercised to the extent that pork scraps and offal are not fed back to the pigs. Ordinary inspection of the pork is of no value. Skin tests on the pigs with destruction of the infected ones may prove to be of practical value. The major responsibility rests with the consumer and those persons having to do with the preparation of food for others. They must be indoctrinated with the idea that all pork and pork products must be thoroughly cooked before they are eaten or served to others. This has apparently been well done in our Navy.

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DIVERTICULUM OF THE STOMACH

By PAUL RICHMOND, Jr., Commander, Medical Corps, United States Navy

In the *Annals of Internal Medicine*, (vol. 10, no. 4) for October 1936, Martin reports a case of diverticulum of the stomach and reviews the literature. As this is a rare condition the following case occurring at the United States Naval Hospital, Bremerton, Wash., is reported:

History.—J. C. T., lieutenant, United States Navy, age 47, entered the hospital May 19, 1936. No complaints at time of admission. Came for check-up on gastro-intestinal tract. About 1 year previous patient started having vomiting attacks. He had 12 or 15 such attacks during the year. Seven months previous to admission he vomited about a teaspoonful of bright red blood. The following day there was a trace of blood noted in the vomitus but none since. No nausea accompanied the attacks. Vomiting was violent and the stomach emptied quickly after which the patient felt well. Attacks were not brought

on by the ingestion of food but apparently by taking fluids, particularly alcoholic liquids. There had been no regularity in the time of occurrence. No abdominal pain or tenderness had been present at any time. Previous history revealed no serious illness or symptoms suggesting gastric ulcer. Patient had never been constipated. He was a moderate user of alcohol. Family history elicited no relevant facts.

Physical examination.—Moderately obese but no recent change in weight. Three lower incisor teeth present, all others replaced by dentures. Blood pressure 160/100. Heart sounds normal. No demonstrable cardiac enlargement. Abdomen normal on palpation. No other abnormalities noted.

X-ray examinations.—Stomach: There is a diverticulum of the anterior medial surface of the cardia. At the 6-hour period the barium is in the diverticulum, but none in the rest of the stomach. The barium is also present in the diverticulum at 24 hours. Duodenum: Except for a slight spasm the duodenum is normal. Colon: The colon has emptied at 24 hours. Abdomen: Flat plate negative. Lumbar spine: There is an acute angulation of the lumbo-sacral spine. No forward slipping as yet.

Laboratory examinations.—Faeces negative for occult blood, ova or parasites. Kahn test negative. Routine urinalysis normal. Mosenthal test showed normal kidney function. Electrocardiogram-rate 107. Deep Q wave in lead three. Isoelectric T wave in lead three.

Clinical course.—No vomiting or other symptoms referable to the stomach were present during period of hospitalization. Remaining teeth were extracted and new dentures constructed. Patient was placed on a reduction diet with loss of about 15 pounds in weight. Surgical consultant advised operation.

On July 22, 1936, he developed tenderness over both frontal sinuses. Examination revealed pus about middle turbinate on both sides; mucous membrane congested. X-ray showed clouding of left frontal and maxillary sinuses. Treatment for sinusitis was carried out. Patient returned to duty. He was readmitted October 10, 1936, with broncho-pneumonia and died from this disease October 12, 1936. There had been no gastro-intestinal symptoms in the interval and there were none during his last illness. He had regained the weight lost on the reduction diet. The use of alcohol had been continued as previously. Abdominal palpation on day of admission revealed no rigidity, tenderness, or masses.

Autopsy findings.—Subcutaneous fat at umbilicus $3\frac{1}{2}$ centimeters thick. Greater omentum was bunched together, just below the stomach. The stomach was distended. The small intestines were distended with gas. There was much fat in the abdominal cavity. No intestinal adhesions were present. No free peritoneal fluid was present. The appendix was retrocecal. The gall bladder was adherent to the stomach wall. There was a dilatation, $3\frac{1}{4}$ centimeters in length, with a broad base measuring about 3 centimeters in diameter, situated on the left side of the stomach, between the stomach and the spleen, and directed posteriorly. This diverticulum was very thin walled. Between the palpating fingers it seemed to be only serosa. There was no induration or thickening about the margins. On opening the stomach no ulceration or hemorrhagic areas were found. The thinned mucosa lining the diverticulum pouch showed faint whitish scars of healed superficial ulceration. The liver weighed 3,262 grams. It extended about 1 inch below the costal margin. The surface was smooth and glistening. On section the color was bright pink mottled with yellow. Microscopic study revealed marked fatty degeneration and an early peri-portal cirrhosis.

An extensive broncho-pneumonia was found as the cause of death. No other relevant pathology was found.

Comment.—Although the X-ray visualization seemed to show the diverticulum to be located on the lesser curvature and anteriorly near the entrance of the oesophagus actually the protrusion was found to be on the highest part of the greater curvature and directed posteriorly. Turning the patient into the position to get the best silhouette resulted in this illusion. Stereoscopic plates or a series of exposures in different positions would have revealed the true location of the diverticulum and are therefore to be recommended in such cases before operative interference is attempted.

ACUTE INTESTINAL OBSTRUCTION DUE TO ROUNDWORMS

By WILLARD S. SARGENT, Lieutenant Commander, Medical Corps, United States Navy

Since intestinal obstruction is so serious and since most acute cases die unless early surgery be instituted, an immediate and correct diagnosis is very essential, and yet it is not always easy because the condition is often protean in its aspects, has many and varied causes, and so many cases are not seen until late. The time of death, if it occurs, varies with the individual and the location of the obstruction. Our case falls under the class due to foreign bodies, with spasm or spastic ileus superimposed.

REPORT OF CASE

History.—A schoolboy of Guam, age 10, was admitted with violent abdominal pain and moderate shock. He had had a similar, though much milder, attack 1 month before, otherwise his past and family histories were negative. He was admitted about 7 p. m., having suffered at home for 3 hours, with a constant severe pain, about the umbilicus and right iliac fossa, to which was added periodic cramplike pains. Vomiting had occurred twice, but it gave no relief, and he has passed no feces or gas by bowel. It was a surprise to learn that food and purgatives had been withheld. Blood had not been vomited and no blood or mucus had been passed by bowel.

Examination.—On admission he showed evidence of pain in that he was curled up and groaning, and shock was evidenced by perspiration, pallor, a pulse of 126 and a temperature of 97.8°. The physical examination was negative except for the abdomen which was distended throughout, particularly in the right iliac fossa and near the umbilicus; there a slightly movable and tender mass, with a doughy feel was encountered. No peristaltic waves were noted. On auscultation loud peristalsis existed and gas was further evidenced by percussion in the upper and left abdomen. The hernial openings and the rectum were normal.

The urine was normal, the white blood count was 18,350 with 86 percent polys, and the feces showed many ova and parasites of *ascarus lumbricoides*.

Treatment.—Shock was treated by blankets, hot water bottles, and elevation of the foot of the bed. After about half an hour a hot enema was given, when feces but no gas was passed, and the general condition of the patient including pain was markedly improved, but the mass persisted. After 2 hours of observation, the enema was repeated, which gave little result, produced no gas, and did not affect the abdominal mass. The pain stopped, the general

condition improved, and fever began to appear so he was carefully watched during the night and the following morning the mass, which had felt so much like worms by palpation, was gone, slight fever was present, and he had passage of gas and feces. Feeling the condition to be due to worms, oil of chenopodium in 1 cubic centimeter dose, repeated in an hour and followed by salts, was given, after which he passed nine ascarus worms. The next day he was given santonin and calomel 2 grains of each followed by a purgative and he passed 78 worms; making a total of 87. He was discharged 4 days later in good condition and no blood or excess mucus was found in the stools during his hospital stay.

COMMENT

This was a case of acute intestinal obstruction at the terminal ileum and cecum by the round worm, *Ascarus lumbricoides*, accompanied by a spastic ileus due to the irritation from the worms. Even these cases may need operative interference.

Very likely the hot enema helped to relax the spastic intestine and the hot-water bottles to the abdomen caused the worms to increase their movement and help untangle them so that relief was obtained before damage was done. Vermifuges were withheld until a diagnosis could be certain, because of the danger of gut rupture, peritonitis, and gangrene. Sudden subsidence of pain in any abdominal condition might be a signal of gangrene but in this case the general condition and all signs improved which ruled out gangrene.

In diagnosing obstruction due to worms we must exclude other causes and prove the presence of worms; the latter can be proven by stool examinations, but in this locality this is of little help because practically all cases have worms. The exclusion of other conditions is important:

1. No history of previous inflammation and no evidence of tuberculosis was found in this case to suggest adhesions or bands as a cause.

2. Appendicial abscess was ruled out by the history and the physical examination.

3. Volvulus usually occurs in adults, in the left side and a mass is not felt.

4. Intussusception causes about one-third of all cases of acute obstruction, it occurs more in children as the bowel is more mobile and irritable, and it often causes a mass in the right lower abdomen and blood and mucus in the stool. Tenesmus is common.

5. The hernial openings were free in this case and this excluded external hernia, while internal hernia are often not diagnosed until operation.

6. Tumors within and outside of the bowel were unlikely on account of the sudden onset and present physical condition.

7. Cicatricial stricture was unlikely as no past evidence of tuberculosis or typhoid was found.

8. Post-operative ileus was out of the question.
 9. Reflex renal obstruction was ruled out by the mass in the side, and urine studies.
 10. There was no cardiac or hepatic disease that would account for mesenteric thrombosis or embolism.
 11. The age and the history did not point to gallstones or enteroliths.
 12. A rectal examination and the enemas ruled out fecal impaction.
- It is hard to stand by and not do an emergency laparotomy in a case presenting symptoms of acute intestinal obstruction, particularly when the average mortality is 40-50 percent, and when a case is got early as this case was. However due to the fact that the pain was markedly relieved by the soda solution enema, and the shock disappeared after same, the general condition improved, and especially where the masses felt like worms in the gut (a sensation obtained clinically at the bedside and at the autopsy table in dead children who also had worms), I felt justified in waiting further developments; which in this case was very fruitful.

A REPORT OF THREE CASES OF AGRANULOCYTOSIS

By C. L. BLEW, Lieutenant, Medical Corps, United States Navy

Agranulocytosis, also known as agranulocytic angina, malignant neutropenia, granulocytopenia, and granulopenia, is a relatively new disease having been first described as a clinical entity by Schultz in 1922. A chronic recurrent form was described by Rutledge in 1930. A recent paper by Davis in the NAVAL MEDICAL BULLETIN discusses this disease and reports two cases in a concise and very-well-written article. I have nothing to add to the facts known of this disease, but the following observations caused me to submit this report.

During the calendar years 1933-36 there were 8,728 admissions to the Naval Hospital, Puget Sound, including three cases of agranulocytosis.

- (1) These three cases occurred in the fall and winter months.
- (2) They were all admitted with the chief complaint of some throat ailment.
- (3) There was a syphilitic history obtained from all cases and very recent arsphenamine treatment had been administered to each.
- (4) In cases 2 and 3 the throat findings were not those usually seen in acute infections.
- (5) No drug commonly blamed in this disease other than arsphenamine was found to have been taken in an amount sufficient to produce symptoms.

CASE 1

H. G. P., sea. 2c, admitted November 13, 1933.

Diagnosis.—Tonsillitis Acute.

Chief complaint.—Sore throat.

Past history and family history.—History of a recent luetic infection for which he had received three injections each of neoarsphenamine and bismuth salicylate. Past history and family history otherwise had no bearing on present illness.

Present illness.—Onset 3 days before admission with fever, sore throat, and general malaise. Admitted to the hospital as a stretcher case.

Physical examination.—Temperature 101° F., pulse 100, respiration 20. Examination revealed a grayish patch on right tonsil and marked stomatitis of left side of throat. There was a small ulceration in left nostril. Evidence of a healed sore on penis. Physical examination otherwise negative. Urine, negative; Kahn, negative; Vincent's angina smear of throat, positive; red blood cells 4,040,000, Hb. 80 percent; white blood cells 6,700; Diff. Polys. 67 percent, Seg. 62, Band 3, Juv. 2, Eos. 1, Lymph. 32.

Progress.—For the next 8 days temperature varied from 101° to 105° F., pulse from 100 to 130. Respiration varied from 20 to 24 until November 18 when it suddenly rose to 35 and continued between 35 and 45 for the next 11 days. X-ray of chest November 18 negative. X-ray of chest November 23, partial collapse of the right middle lobe.

Because of the fever, rapid pulse, toxemia, and prostration, patient was given 100 cubic centimeters antistreptococcal serum in divided doses on November 20. White blood cell count the next day showed 1,650, Polys. 30 percent, Seg. 8, Band 4, Juv. 12, Myel. 6, Eos. 8, Lymph 58, Mono 8. Patient was given a transfusion of 500 cubic centimeters of whole blood with a marked improvement in general condition. Temperature fell to 100° F., pulse and respiration lowered and within the week had dropped to nearly normal level. His temperature was slightly elevated to 99° F. in the afternoon for the next month and then fell to normal. On November 26 patient developed serum sickness lasting 2 days.

White blood cell count taken daily from November 21 to December 1 fluctuated between 1,650 and 6,550, except for one count of 14,250 occurring during his serum sickness. Polys. varied from 30 to 60 percent. On December 6 the white blood cell count dropped to 2,625 with 24 percent granular cells. During the period December 8 to December 17 patient received 80 cubic centimeters of pentnucleotide intramuscularly. The white blood cell count slowly and gradually increased until January 9, 1934, when total white count was 8,250 with 62 percent polys. Convalescence was complicated by the development of an anal fissure on December 21, 1933, but this had no disturbing effect on the rising granulocyte count. On three occasions blast cells were observed in the stained blood smear. On November 23 two lymphoblasts were found, on November 25 one lymphoblast, and on December 7 two monoblasts were observed. Patient was allowed up and about on December 29 and was discharged to duty, well, on January 22, 1934.

CASE 2

O. D., sea. 1c, admitted November 28, 1935.

Diagnosis.—Tonsillitis acute.

Chief complaint.—Sore throat.

Past history and family history.—Contracted syphilis in August 1933, Kahn 4+. Treated consistently since first appearance of chancre. Total treatment, 68 injections of neoarsphenamine, 49 injections of bismuth, potassium iodide. Received his last injection of neoarsphenamine 2 days prior to admission.

Present illness.—Onset 2 days ago. Received an injection of arsenic in the morning and then went on watch. Had a mild chill during his watch, slept poorly that night; noted that his throat was sore. Reported to sick call next morning and was transferred to the hospital.

Physical examination.—Temperature 103°F., pulse 104, respiration 20. Throat smear positive for VA. Appearance of throat did not suggest an acute tonsillitis even in the presence of injection of the mucous surfaces. Patient not toxic; mentally alert. Physical examination otherwise negative. Urine. Negative; Kahn, 4+ (December 2, 1935), red blood cells 4,110,000, Hb. 74 percent; white blood cells 700 and 1,000 on two counts; Diff. Seg. 9, Lymph. 81, Mono. 10. Polymorphonuclear cells show disintegration.

Progress.—November 28, 1935, patient was given a transfusion of 500 cubic centimeters of whole blood. November 29, temperature 101.4° F., pulse 104, respiration 18. White blood cells 1,320, Seg. 11 percent, Eos. 1, Lymph. 78, Mono. 9, Turck 1. Temperature fell to normal on the sixth hospital day and remained so. Pulse normal. Treatment consisted of intramuscular injections of pentnucleotide, 10 cubic centimeters twice daily. This patient received 120 cubic centimeters of pentnucleotide from November 29 to December 5. Liver extract and Lextron were also given by mouth. Daily blood counts from November 28 to January 8 showed a gradual and steady rise from 700 to 8,100 with normal distribution. Patient was discharged to duty January 10, 1936, well.

CASE 3

M. J. B., CGM. (AA), admitted December 21, 1936.

Diagnosis.—Abscess peritonsillar.

Chief complaint.—Bleeding from the right tonsil.

Past history and family history.—Contracted syphilis in 1923. Treatment abstract from March 25, 1926, to November 28, 1926, 16 injections neoarsphenamine, 40 mercury; from January 15, 1931, to October 25, 1932, 15 injections neoarsphenamine, 16 bismuth; from August 15, 1933, to October 17, 1935, 15 injections of neoarsphenamine, 29 bismuth; from August to December 1936 patient received 9 injections of neoarsphenamine and 7 of bismuth. Blood Kahn has varied from 1+ to 4+ since original infection. Spinal Kahn on December 8, 1936, was 4+. Received one injection of 3 grams tryparsamide on December 15, 1936.

Present illness.—Onset of sore throat 1 week before admission, treated with hot gargles. The day before admission expectorated a few small blood clots from his throat. According to the patient's statement these came from the right side. Soreness in throat became worse during the following 24 hours so patient reported to the sick bay. Diagnosis of peritonsillar abscess was made with an incision in the right tonsillar area. Following the incision there was a hemorrhage and patient was then transferred to the hospital.

Physical examination.—Temperature 100.8° F., pulse 132, respiration 22. Patient is an adult white male lying in bed, expectorating blood clots from his mouth and throat. Color ashy. Cold, clammy sweat on face and forehead. Pulse rapid, of poor volume and tension. Blood pressure 104/70.

Throat examination.—Right tonsil enlarged, not typical of an acute throat infection nor of a peritonsillar abscess. Mucous membranes pale. Hemorrhage from right tonsil which is controlled with pressure. Scattered purplish, purpuric spots observed on forearms, back, buttocks, and legs, being most numerous on legs. Slight general adenopathy. Urine showed occasional red blood cells and white blood cells and was 1+ for albumin. Blood Kahn was 4+. Physi-

cal examination otherwise negative. Blood count red blood cells 2,070,000, Hb. 40 percent, color index 0.94, white blood cells 950, Seg. 2, Band 2, Lymph. 96. Reticulocytes 0.6 percent. Patient was immediately transfused with 400 cubic centimeters whole blood.

Progress.—Temperature varied from time of admission to death from 100.8° to 105.4° F. Pulse varied from 116 to 140, respiration from 20 to 44. During the short time the patient lived he was given three transfusions totaling 1,100 cubic centimeters. He received 140 cubic centimeters pentnucleotide intramuscularly. No further bleeding from throat was observed following admission. During the day of December 23 patient's condition did not improve with pentnucleotide, intravenous glucose and saline and transfusions and respirations gradually increased from 25 to 45 with respiratory embarrassment which necessitated use of the oxygen tent.

Complete blood count December 22: Hb. less than 40 percent (Hellge), red blood cells 1,560,000, white blood cells 950; Diff. Seg. 6, Band 2, Lymph. 92 percent.

Complete blood count December 23: Hb. 30 percent, red blood cells 1,510,000, white blood cells 1,100; Seg. 4, Lymph. 96 percent, reticulocytes 0.4 percent, platelet count 9,200.

The patient died at 19:55, December 23, 1936. Autopsy showed a hypostatic pneumonia of both bases and purpuric hemorrhages into pleura, liver, spleen, and kidneys.

REMARKS

Case 1.—This is an example of interference in bone-marrow function without a complete cessation of white-cell production. Two relapses were observed with ultimate recovery. Eighty cubic centimeter of pentnucleotide were administered.

Case 2.—A typical case. Recovery was prompt. One hundred and twenty cubic centimeters of pentnucleotide were administered.

Case 3.—Admitted so near extremis that no treatment availed and he died 2 days after admission. This case showed severe disturbance in formation of all the cellular elements of the blood, a pen-myelophthisis. One hundred and forty cubic centimeters pentnucleotide were administered. As this preparation requires about 4 days to manifest its effects the patient did not live long enough for any leucocytic response.

I cannot believe with Kracke as quoted in Davis' article that infection is the best treatment of granulopenia. Where there is only a depression of production of granulocytes, infection may stimulate hematogenesis. In case 1 the stimulus of infection may have helped as shown by the fluctuating white count. However, in instances where there is an almost total absence of granulocytes, as in case 3, I cannot see that infection aids recovery.

CONCLUSIONS

Here is a relatively new disease of unknown causation. We blame benzol, arsenic, arsphenamine, TNT, dinitrophenol, and amidopyrine.

In the Navy we are mainly concerned with arsphenamine. To see an apparently healthy young adult report to sick call one morning and see him on a slab in the morgue within 5 days is rather staggering.

I wish to propose the white blood count as an added help in treating our luetic cases more safely. We do the Dickens' test for arsenic, examine the urine for albumin, and watch the mouth for salivation. Cannot we also resort to a white count and differential for the case which does not seem in robust health or who reacts poorly to arsenic medication? Roberts and Kracke reported a mild granulopenia in one out of every four examined in a private clinic. Patients under arsphenamine medication might present the same trend or even a more frequent transient granulopenia. Close observation of all patients about to receive a course of arsphenamine should disclose some of these granulopenias in the early stages and a hemoglobin estimate together with a white blood count and differential contraindicate further administration of arsenicals.

Further, a throat complaint which shows atypical findings should call for a complete blood examination.

Pentnucleotide (K-96) seemed to be most beneficial in our treatment. Liver extract by mouth or intramuscularly probably should be employed also, especially when the hemoglobin or red cells are diminished.

SUGGESTED DEVICES

A POISON ANTIDOTE BOX

By JAMES D. BLACKWOOD, Jr., Lieutenant Commander, Medical Corps, United States Navy

To be awakened suddenly in the middle of the night from a sound sleep with the announcement that someone has taken some form of poison is not conducive to clear thinking.

As time is an important factor in the saving of the patient's life, it should not be wasted in consulting books for the name of the antidote and in assembling the necessary drugs and equipment for the combating of the poison.

Having had the experience, the writer decided, during calmer moments, to prepare for such another contingency.

A list was made of the various poisons usually kept in homes and of those used in the industrial departments of navy yards and antidotes were prepared in convenient doses.

The question arose regarding an easily transported container. As we have a black cabin bag equipped for outside calls, it was decided to use something markedly different in appearance so that there would be neither delay nor a mistake in immediately taking the correct container. A wooden box 9 by 13 by 9 inches was covered with canvas, the top canvas being hinged and equipped with a handle and lashings.

A list of common poisons with their antidotes and directions for their use was placed in the box, together with a stomach tube, boric acid ointment, material for demulcent drinks (acacia, cottonseed oil), emetics (apomorphine and mustard), a hypodermic case containing cardiac and respiratory stimulants and morphine, and the various antidotes.

When a call comes to attend a case of poisoning, it is necessary only to pick up the antidote box and go. When you see the patient, find out the poison taken, consult the list in the box, and use your antidote.

Following is the list:

Acids (mineral): Cardiac stimulants, morphia to relieve pain, baking soda or sodium bicarbonate in milk, egg albumin, carbonate of magnesia, mucilaginous drinks, sweet oil, chalk, soap and water. General emetic, 2 teaspoonsful of mustard in glass of lukewarm water.

Alkalies (caustic): Same as Lysol.

Alkaloids (except morphine): Gastric lavage with tannic acid (teaspoonful to pint of water), tannic acid grs. X.

Arsenic: Evacuation of stomach, bland and mucilaginous drinks, ferric hydroxide in milk, barley water followed by castor oil.

Bichloride: White of an egg for each 4 grains of poison taken. Emetics: Demulcent drinks, milk, or ice water.

Cocaine: Lavage; tannic acid or tea, external heat, artificial respiration. Physiologic antidotes: Morphine, ether, chloroform, chloral, amyl nitrite.

Copper sulphate: Potassium ferrocyanide, grs. V-X; soap; alkalies.

Cyanides: (1) Artificial respiration; (2) Amyl nitrite—1 ampule every 30 minutes and finally 1 ampule every 2 to 5 hours as respiration and pulse approach normal; (3) Methylene blue, 1-percent aqueous solution, 60 cubic centimeters intravenously.

Iodine: Starch freely; induce vomiting; demulcent drinks; stimulants by hypodermic; external heat.

Lysol: Oils, dilute vinegar lemon juice, cardiac stimulants by hypodermic; external heat.

Morphine: Lavage or emetics (KMNO_4 , 20 grs. to pint of water); cathartics and diuretics; caffeine or strong coffee; oxygen or artificial respiration

Oxalic acid: Chalk, limewater; then mucilaginous drinks and oils.

Phenol: Magnesium sulphate or sodium sulphate; emetics; stimulants, such as coffee, ether, atropine, demulcent drinks; external heat.

Silver nitrate: Sodium chloride.

Sodium fluoride (cockroach poison): Large doses of calcium acetate or calcium chloride. Wash out stomach

Strychnine: Emetics; chemical antidotes; tannic acid, teaspoonful to a pint of water; chloroform inhalations; potassium bromide in large doses or chloral hydrate.

NAVAL RESERVE

REPORT OF SELECTIONS AND PROMOTIONS

A Medical Corps selection board of which Admiral John B. Dennis, Medical Corps, United States Navy, was senior member, convened at the Navy Department on May 10, 1937, for selection of one officer to the rank of captain and seven to the rank of commander, from the Reserve list of the Medical Corps. Captain Porter B. Brockway (M. C.), U. S. N. R., of Toledo, Ohio, was a member of this board.

This board selected Clifford E. Henry, commander, M. C.-V. (S) for promotion to captain. Commander Henry is from Minneapolis, Minn., and will be promoted as of August 1, 1937.

The selections for commander included:

Clarence A. Berger, lieutenant commander, M. C.-V. (G), U. S. N. R.

Rutherford B. H. Gradwohl, lieutenant commander, M. C.-V., U. S. N. R.

Eretas E. Biddinger, lieutenant commander, M. C.-F., U. S. N. R.

Arthur C. Sinton, lieutenant commander, M. C.-F., U. S. N. R.

Robert H. Butler, lieutenant commander, M. C.-V. (S), U. S. N. R.

Philip K. Gilman, lieutenant commander, M. C.-V. (S), U. S. N. R.

Emil J. Stein, lieutenant commander M. C.-F., U. S. N. R.

Lt. Comdr. Berger is from Toledo, Ohio. Lt. Comdr. Gradwohl is from St. Louis, Mo. Lt. Comdr. Biddinger is from Cleveland, Ohio, and Lt. Comdr. Sinton is from Richmond, Va. The commissions of these officers will be dated January 1, 1937.

Lt. Comdr. Butler is from Bellefontaine, Ohio, and his commission will be dated June 1, 1937.

Lt. Comdr. Gilman is from San Francisco, Calif. His commission will be dated August 1, 1937.

Lt. Comdr. Stein is from Chicago, Ill. The date of his commission is still indefinite.

NAVAL RESERVE CONFERENCE

By order of the Secretary of the Navy a conference of officers from the United States Navy and the United States Naval Reserve convened at the Navy Department on July 7, 1937, and was in session

10 days. The objective of this conference was to obtain information and formulate policy for the United States Naval Reserve. Lt. Comdr. James S. Klumpp, M. C.-V. (S), United States Naval Reserve, was a representative of the Medical Department at this conference.

PROMOTIONS, SECOND QUARTER, 1937

Capt. LeRoi Goddard Crandon, M. C.-V. (S), U. S. N. R. Promoted from: Commander. March 31, 1937. 366 Commonwealth Avenue, Boston, Mass.

Lt. Roger Goldie Osterheld, M. C.-V. (G), U. S. N. R. Promoted from: Lieutenant (junior grade). April 2, 1937. Taunton State Hospital, Taunton, Mass.

Lt. Charles Leroy Denton, M. C.-V. (S), U. S. N. R. Promoted from: Lieutenant (junior grade), M. C.-V. (S). April 26, 1937. Dyersburg, Tenn.

Lt. John Kipp Hawes, M. C.-V. (G), U. S. N. R. Promoted from: Lieutenant (junior grade), M. C.-V. (G), June 1, 1937. 683rd Company, C. C. C., Camp Wolverine, Clarion, Mich.

Lt. Arthur Julian Horton, M. C.-V. (G), U. S. N. R. Promoted from Lieutenant (junior grade), M. C.-V. (G), June 28, 1937. 205-28 One Hundred and Twelfth Road, Hollis, Long Island, N. Y.

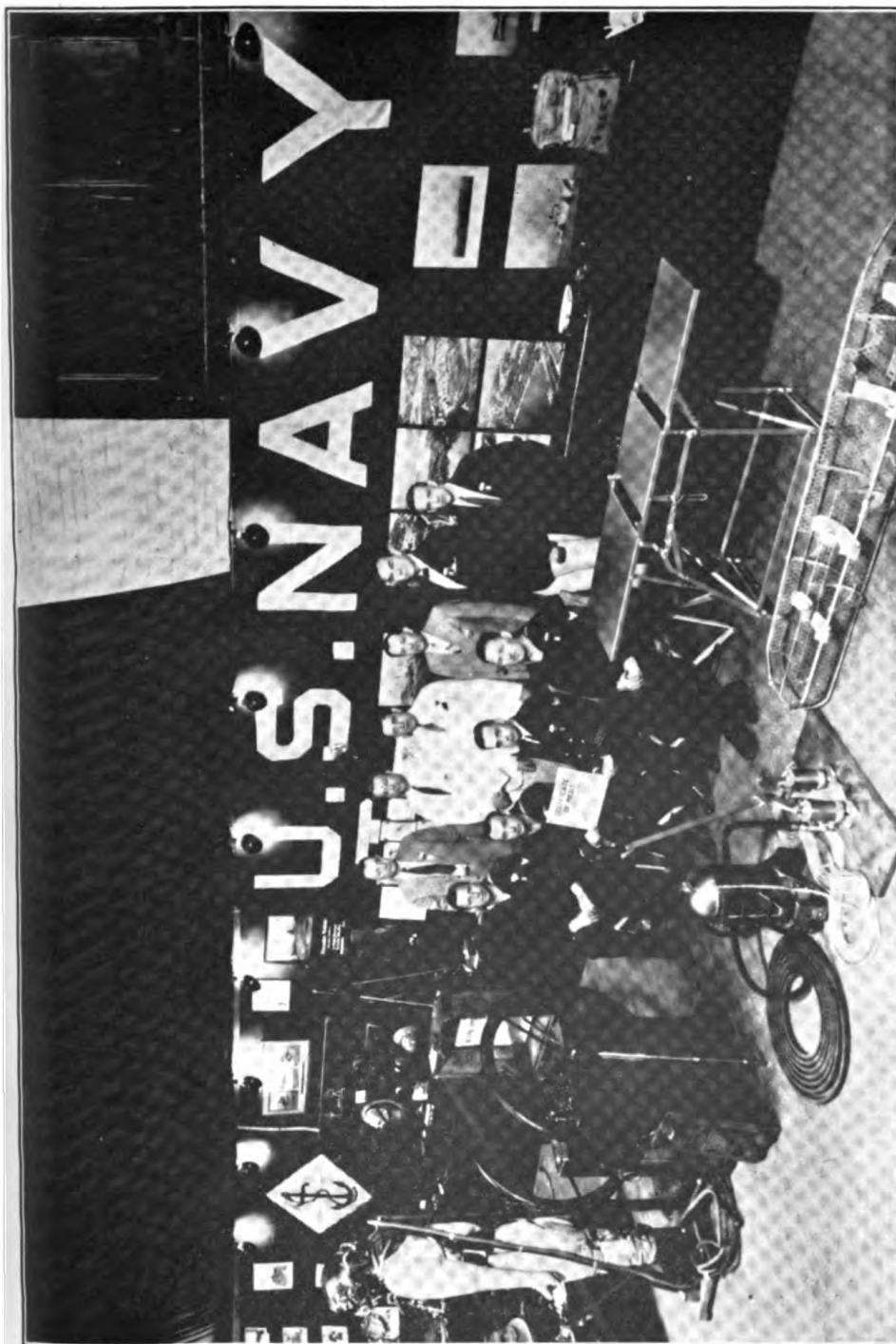
RETIREMENTS, SECOND QUARTER, 1937

Commander Albert Soiland, M. C.-V. (S), U. S. N. R. Honorary Retired List, United States Naval Reserve. June 1, 1937. 1407 South Hope Street, Los Angeles, Calif.

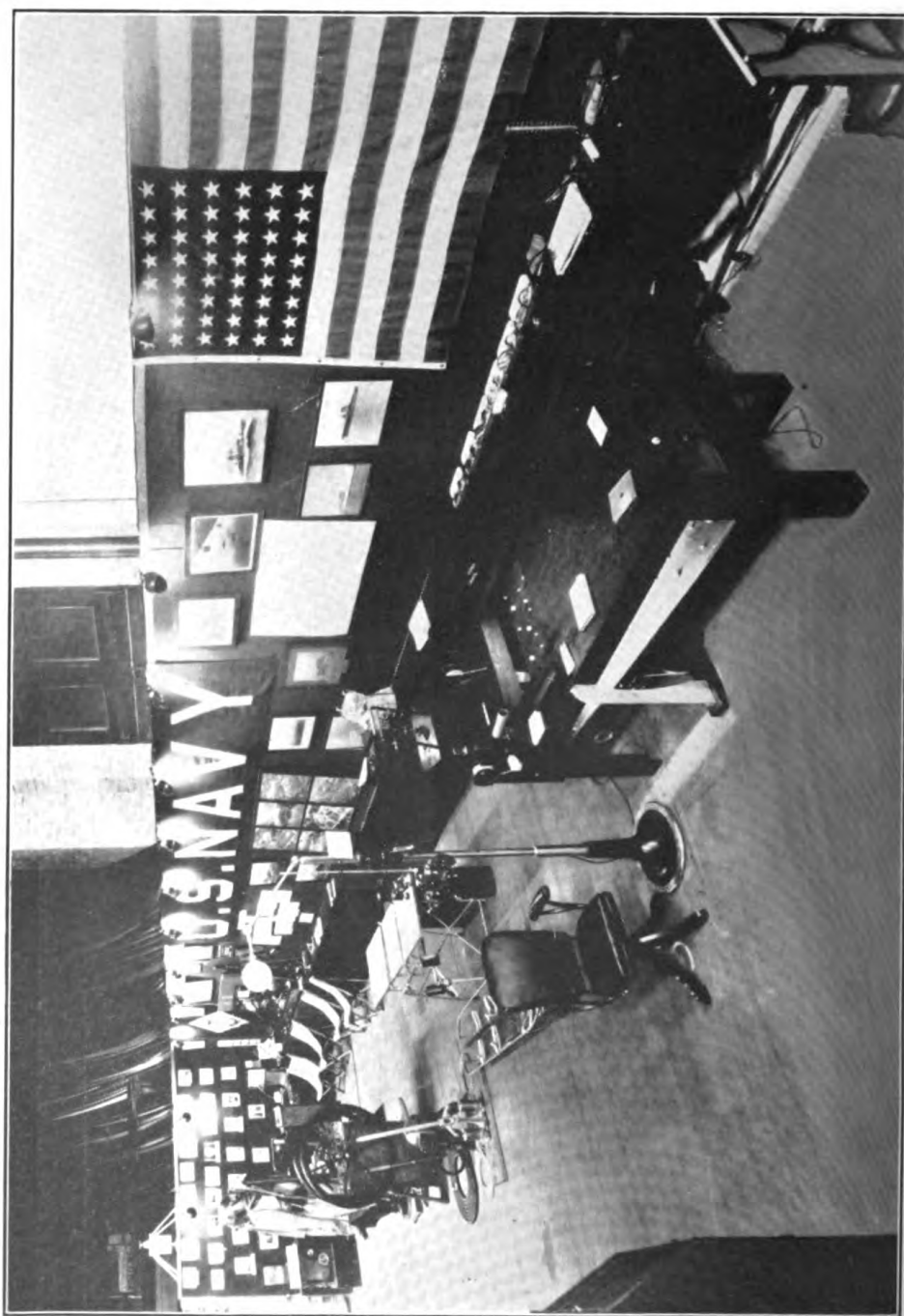
CREDIT FOR ACTIVE DUTY

Bureau of Navigation's Circular Letter No. 6-37, dated June 15, 1937, amends articles H-3501 and H-3502, on the Naval Reserve, of the Bureau of Navigation Manual to read:

Medical officers will be credited with 1 day's training duty for promotion purposes for every five physical examinations conducted while in an inactive duty status. A report of such examinations certified by the commanding officer or commandant concerned shall be forwarded annually with the officer's annual fitness report or with his application for promotion.



Personnel at Navy Exhibit, Atlantic City Convention of the American Medical Association. Left to right, front row—E. J. Norcus, Ph. M. (1st cl.), U. S. N.; G. A. Neville, Ph. M. (1st cl.) U. S. N.; C. Shearer, C. Ph. M., U. S. N.; C. Shorter, Ph. M. (2d cl.), U. S. N. Back row—Comdr. C. S. Stephenson (M. C.), U. S. N.; Comdr. F. S. Johnson (M. C.), U. S. N.; Lt. Comdr. J. F. Neuberger (M. C.), U. S. N.; Lt. Comdr. W. P. Biggs (R.), U. S. N. R.; Dr. J. F. Neumuller, and Mr. James E. Trafton.



NAVY EXHIBIT.



NAVY EXHIBIT.



NEWTON L. BATES
Surgeon General, United States Navy, 1897.

NOTES AND COMMENTS

NEWTON L. BATES, SURGEON GENERAL, UNITED STATES NAVY, 1897

By LOUIS H. RODDIS, Commander, Medical Corps, United States Navy

The eleventh Surgeon General, United States Navy, and the fifteenth Chief of the Bureau of Medicine and Surgery. This Surgeon General was born in New York and appointed from that State as an assistant surgeon in the Navy on July 30, 1861. He was first attached to the Naval Hospital, New York, and then did duty on the U. S. S. *Seneca* in the South Atlantic Blockading Squadron. Later he went to the U. S. S. *Benton* of the Mississippi Squadron. He thus saw much active service at sea during the Civil War. From 1864 to 1867, he was attached to the United States Naval Laboratory at New York. This laboratory was the forerunner of the Naval Laboratory and Department of Instruction, from which was created the Naval Medical School, Washington (1902), and the Naval Medical Supply Depot (1906). It had been founded in 1853, and it was here that Surg. B. F. Bache and Passed Asst. Surg. E. R. Squibb, later the founder of the great commercial pharmaceutical house, began and carried on the manufacture of chloroform and ether for the Navy.

The future Surgeon General had been promoted to the grade of Surgeon on September 16, 1865. He saw much sea duty after the Civil War, serving on the U. S. S. *Portsmouth*, the *Swatara*, *Miantonomah*, *Pawnee*, *Brooklyn*, (fleet surgeon), and *Minnesota*. He commanded the United States Naval Hospital, Yokohama, Japan, for 2 years. He was attending surgeon in Washington, D. C., for 3 years, 1884-87. He had been promoted to medical inspector in June 1881, and medical director September 1888. He commanded the Naval Hospital, Mare Island, after which he returned to Washington for duty. He was appointed Surgeon General of the Navy by President McKinley (of whom he was a close personal friend and one of his trusted medical advisors) on October 1, 1897. Dr. Bates was ill at the time and, in fact, was sworn in at his home, not being able to go to his office in the Navy Department. He died 18 days later, on October 18, 1897.

CERTIFICATE OF MERIT AWARDED NAVY EXHIBIT

At the annual convention of the American Medical Association held in Atlantic City, N. J., from June 7 to 11 this year the Medical Department of the United States Navy entered an exhibit in the educational section and was awarded a special certificate of merit for "its exhibit on naval medical activity pertaining to aviation medicine; preventive, and industrial medicine; and public health." This certificate of merit is the highest award for excellence in the class in which the Navy was entered. So far as has been determined this is the first time the Navy has won an award for a medical exhibit.

The material exhibit consisted of the following: Submarine lungs—in cross section—in order of their development. Devices for the detection of carbon monoxide and carbon dioxide, the former being so constructed that an alarm is sounded when the concentration of carbon monoxide reaches a determined dangerous limit. Gas masks for protection against the commonly encountered industrial gases as well as a complete line of hoods and masks to protect industrial workers from the hazards of sandblasting and other abrasive materials. Smoke helmets of various types of construction and usefulness. Goggles for the protection of the eyes of workers engaged in such work as might produce eye injuries. This phase of the exhibit was augmented by demonstrations of the various types of lenses and their ability to withstand impact from flying particles as well as the methods used in determining the nature of fragmentation of the cheaper lenses when broken in service and the test methods of acceptance of safety "shatter proof" lenses from contractors. A complete display of safety devices used by the Navy in industrial activity, afloat and ashore, was presented and developed much interest in those members of the profession engaged in industrial medicine.

Of particular interest was the breathing resistance apparatus designed exclusively by the Navy to determine the resistance to breathing offered by canisters and various other safety breathing devices. The diving activity of the Navy was illustrated by both shallow and deep-sea diving equipment. The diver's air requirements were presented together with decompression tables.

It is difficult to estimate what section of the exhibit afforded the greatest interest to the visitors, but it is safe to say that the diving equipment attracted the largest crowds during the entire session of the convention. A splendid collection of photographs illustrating the morbid anatomy of compressed air illness was displayed and these photographs received close study by many physicians interested in industrial activity associated with accidents from compressed air. Other photographs illustrated the activities of the Medical Department of the Navy, both afloat and ashore. In the former instance,

views of the sick bays of various ships, including hospital ships, were shown. The photographs of shore activities included views of dispensaries and hospitals, with particular reference to industrial-accident prevention. Photographs of the various types of ships, surface and submarine craft, especially the latter, held the interest of all visitors, many of whom commented on the splendid collection of photographs of the Navy.

The aviation medicine section demonstrated the latest equipment used in aviation physical examination and supplemented its work with numerous photographs of medical activity concerned with the aviation industry. Of special interest in this connection was the demonstration of the "tilting field" developed by Dr. J. F. Neumueller of the American Optical Co. This device is designed to determine the aviator's visual accommodation at the moment of landing. Dr. Neumueller and his assistant, Mr. James E. Trafton, volunteered their services and the loan of optical equipment and were in attendance during the entire session of the convention.

About 1,250 square feet of wall space were utilized to display photographic illustrations of various phases of naval medical interests, including items on public health, industrial hygiene, industrial medicine, preventive medicine and safety appliances. The visitors to the exhibit averaged 1,640 per day and on the third day exceeded 2,200.

The exhibit was presented by Rear Admiral P. S. Rossister, Medical Corps, United States Navy, Surgeon General, United States Navy, and was directed in Atlantic City by Commander C. S. Stephenson, Medical Corps, United States Navy; assisted by Commander F. S. Johnson, Medical Corps, United States Navy; Lt. Comdr. J. F. Neuberger, Medical Corps, United States Navy; Lt. Comdr. W. P. Biggs, United States Naval Reserve, Navy Department safety engineer; and Dr. J. F. Neumueller and Mr. James E. Trafton of the American Optical Co., and the following hospital corpsmen: E. J. Norkus, pharmacist's mate, first class, United States Navy; G. A. Neville, pharmacist's mate, first class, United States Navy; Clarence Shearer, chief pharmacist's mate, United States Navy; and Charles L. Shorter, pharmacist's mate, second class, United States Navy.

The following letter of appreciation from the director of the scientific exhibit of the American Medical Association to the Surgeon General is quoted for its interest to the service: "The committee on scientific exhibit has asked me to express to you its appreciation for the fine exhibit which the Navy prepared for the Atlantic City meeting of the American Medical Association, at which the committee on awards gave to the exhibit a certificate of merit. The energy and

faithfulness which the men showed in preparing and in demonstrating the exhibit and their willingness to give unstintingly of their services without thought of personal gain were very material factors in making the scientific exhibit of great educational value to the medical profession. In addition, let me add my own personal gratefulness for the spirit of cooperation which was shown by all the Navy personnel."

COMBINATION OF THE SCHAFER AND SILVESTER METHODS OF ARTIFICIAL RESPIRATION

In the French Naval School at Toulon, Professor Hèderer made studies of the volume of air entering the lungs during artificial respiration with the Schafer method and with the Silvester method. He reports that with the Schafer method the volume of air gaining entrance to the lung is only about 100-150 cubic centimeters, or less than one third of the normal volume (500 cubic centimeters), while with the Silvester method the volume of air was about 250-280 cubic centimeters. He also believes that the pulmonary circulation is better stimulated by the Silvester method than by that of Schafer. As a consequence of his studies he suggests combining the two methods so as to give the advantages of the Silvester method (greater air volume and better pulmonary circulation) and the Schafer method (posture) which permits the tongue to fall forward and drainage from the lungs.

The patient is placed in the prone or Schafer position, the face being placed on the hand with the head turned to one side, a small roll of cloth under the stomach. One man sits astride of the hips and at regular intervals makes expiratory efforts by pressure on the lower part of the thorax as in the regular Schafer method. The second man kneels at the head of the patient and grasping both elbows pulls the elbows of the subject upwards above the head, without changing the position of the head and hands of the subject, to perform the inspiratory movement, which he alternates with the expiratory efforts of the other person assisting in the resuscitation.

DIENTAMOEBE FRAGILIS¹

This report is based upon research work done at the Gorgas Memorial Laboratory, Panama. The writer reported upon *dientamoeba fragilis* as a probable pathogen in 1935 and recorded his observations

¹ Some further observations by E. G. Hakansson, Lieutenant Commander, Medical Corps, United States Navy, published in the American Journal of Tropical Medicine for May 1937.

upon the identification and viability of this amoeba. The present report is based upon 37 observed human cases of infection by this pathogen and some additional information relative to this amoeba and its relation to the human host.

In a group of inmates at an insane asylum, he reports an annual rate of infection of 42.1 percent. The organism can be identified rather easily in wet smears and stain preparations and is characterized by three distinctive features, namely, a faultless circular outline when at rest and the film-like pseudopodia with sharp points, when motile—both in normal saline smears, and third, in aqueous smears it presents an explosive rupture of the ectoplasm with complete evacuation of the endoplasm followed by restoration of the spherical extoplasmic shell.

Duration of the human infection is variable, some infections apparently terminating spontaneously, others persisting for over a year. In the present series of cases, the clinical symptoms were rather mild, the patients complaining chiefly of some abdominal distress, with mild cramps and gas, mushy stools, and burning of the rectum on defecation. Carbarsone, 0.50 gram doses, twice daily for 2 days, was proved to be effective treatment, although in some cases this course of treatment had to be repeated.

LIVER THERAPY IN SPRUE

Many students of the subject are apparently coming to believe that sprue is a deficiency disease closely related to pernicious anemia or at least that a deficiency factor is one of two or more etiologic agents. This has led to the use of liver therapy in the treatment and a number of observers have reported remarkable results with it. When liver given in the diet and administered orally has failed to bring about adequate response, the parenteral administration is recommended.

EFFECT OF FATIGUE ON THE ADJUSTMENT OF THE EYE TO NEAR AND FAR VISION¹

In this article Robertson reports further work relative to the speed of adjustment of the eye to near and far vision as measured by the tachistoscope. His previous work has been devoted to the reporting of normal findings. In this article he reports the effect of fatigue.

Personnel tested were divided up into various age groups. Tests were primarily made upon pilots after 1, 2, 3, and 4 years of flying and under normal conditions. Tests on nonpilots were included for

¹ By C. J. Robertson, Commander, Medical Corps, United States Navy, and published in the May 1937 issue of Archives of Ophthalmology.

comparison. A total of 628 tests were made. In these tests the three phases of speed accommodation were determined, namely, the speed of accommodation from near to far, the speed of accommodation from far to near, and third, the speed of accommodation from near to far and return to near. The writer determined that fatigue has a marked bearing on speed of adjustment in all ages, especially so as age progresses. He found the age factor important, especially after the age of 30. He recommends that pilots not within the limits of safety be disqualified until they can make normal adjustments.

TUBERCULOSIS IN WILD VOLES¹

This is a preliminary report of a very interesting discovery. Since February of the present year the author has demonstrated microscopic lesions in voles typical of tuberculosis. The vole is a small rodent popularly known as the grass mouse, short-tailed field mouse, or field-meadow vole. It actually does not belong to the mouse family. It constructs interlacing runs in meadows.

It is believed that this is the first demonstration of a tubercular-like lesion in warm-blooded animals in the wild state. It is known that these animals are subject to plague-like diseases which tend to decimate the vole population. Should this disease be proven to be tuberculosis, it becomes a matter of public health interest in that it can serve as a reservoir for the spread of this disease to man and domestic animals. The writer suggests that inasmuch as this seems to be a natural infection of the vole, and as this animal can be readily bred in captivity, it might be wise to substitute this animal for the laboratory demonstration of tuberculosis. Experimental work is under way to demonstrate whether the organism in question is identical with *M. tuberculosis*.

AMERICAN COLLEGE OF SURGEONS

In the October 1932 number of the UNITED STATES NAVAL MEDICAL BULLETIN there is outlined the requirements for admission to fellowship in the American College of Surgeons. For the benefit of new medical officers particularly, these requirements are reprinted here with some slight changes.

The American College of Surgeons invites the Surgeon General each year to nominate a limited number of candidates for fellow-

¹ By A. Q. Wells, D. M., and published in *The Lancet*, May 22, 1937.

ship in the college. It is suggested that officers desiring to have their names considered for nomination submit their applications in compliance with instructions in Circular Letter No. 636, 1937.

It is the fixed policy of the Bureau to sponsor only those officers who, in the opinion of the Bureau, meet the high standard of professional qualifications set by the college and who are prepared to comply with all the professional requirements imposed by the college on candidates from civil life. Should the number of qualified applicants exceed the number of nominees permitted, the order of selection will be according to relative merit.

To be eligible for fellowship the candidate shall be a graduate, of at least 7 years' standing, of a medical school approved by the American College of Surgeons. He shall give evidence that he has served at least 1 year as interne in an accredited hospital and 2 years as surgical assistant, or evidence of apprenticeship of equivalent value. As a means of furnishing precisely the information desired, it is requested that the "application for fellowship" (obtainable from the Bureau) shall be filled out and submitted with the applicant's case reports. Letters also may be submitted by the candidate testifying as to his personal traits as well as to his professional qualifications.

The professional activity of the candidate shall be restricted to the study, diagnosis, and operative work in general surgery or in special fields of surgery, such as eye, ear, nose and throat, genitourinary, orthopedics, and gynecology and obstetrics. As evidence of his qualifications in the technique of surgery, the candidate is required to submit in complete detail through official channels, the case records of 50 consecutive major operations which he has performed himself. In addition to the complete records of 50 consecutive major operations, the candidate is asked to submit in brief abstract a report of at least 50 other operations in which he has acted as assistant or which he has performed himself.

The senior medical officer with whom the candidate is serving, when forwarding these case records and the abstract of major operations in which the candidate has assisted, should furnish, by means of an appropriate indorsement, his estimate of the candidate's qualifications for fellowship.

The attention of prospective candidates is invited to the desirability of having case reports typed on paper of cap size, suitably arranged and bound, and prefaced by both an index to cases (form P) and a summary giving the total number of operations of each type; e. g., appendectomy, 14; cholecstectomy, 2, etc. It is important, further, that each case be identifiable by recording (a) institution; (b) hospital number; (c) date; (d) initials.

The Twenty-seventh Annual Clinical Congress of the American College of Surgeons will be held in Chicago, October 25-29, 1937, with headquarters at the Stevens Hotel. The program includes an extensive schedule of operative clinics, demonstrations at hospitals by subcommittees and the technical exhibition in exhibition hall where registration and clinic ticket bureaus and bulletin boards will be located. Chicago's 5 medical schools and more than 50 hospitals are cooperating with the college in the presentation of this ample and well-arranged program.

AMERICAN COLLEGE OF PHYSICIANS

As in the case of the American College of Surgeons, the requirements for fellowship in the American College of Physicians were printed in the October 1932 number of the UNITED STATES NAVAL MEDICAL BULLETIN, and are reproduced here as it is felt that occasional reprinting of these requirements is a convenience to medical officers who may not have old files or bound copies of the bulletin available.

Several years ago the board of regents of the American College of Physicians adopted a resolution providing that candidates for membership from the Navy shall be indorsed by the Surgeon General of the Navy. The intent of the board of regents was to provide that all applications from officers of the Medical Corps of the Navy shall be forwarded through the office of the Surgeon General of the Navy, who will forward the applications to the college with a letter of indorsement. Candidates so proposed will be required to submit all the data and meet all the usual requirements for associateship, and will be passed upon individually by the committee on credentials for associateship, the board of governors, and the board of regents.

1931 was the last year that candidates could be elected directly to fellowship, except in very special cases. The exceptions, according to a letter recently received from E. R. Loveland, the executive secretary of the college, will only be considered in cases of outstanding internists. He states: "It is thought by our board of regents, and so provided, that in an exceptional case some nationally known authority in the field of internal medicine might be admitted directly to fellowship."

The term of associateship and eligibility for fellowship, to quote article VI, section 3 of the bylaws, follows: "Candidates elected after the adoption of this section (April 1929) shall be elected for a term of 5 years. An associate so elected shall be eligible for election to fellowship at the end of 3 years after his election to associateship."

At the expiration of 3 years he shall be notified in writing by the joint committee on credentials of his eligibility for election to fellowship during the next 2 years, provided he shall meet within that time the requirements necessary for fellowship. If not elected to fellowship within 5 years, his associateship will automatically cease."

At the present time there are 48 members of the Medical Corps listed as fellows and 3 members listed as associates. Application blanks may be obtained by request from the Bureau of Medicine and Surgery. Applicants will comply with instructions of Circular Letter No. 636, 1937.

The twenty-second annual session of the American College of Physicians will be held in New York City, with headquarters at the Waldorf-Astoria Hotel, April 4-8, 1938. Dr. James H. Means, of Boston, is president of the college and will have charge of the program of general scientific sessions. Dr. James Alex. Miller, of New York City, has been appointed general chairman of the session and will be in charge of the program of clinics and demonstrations in the hospitals and medical schools and of the program of round table discussions to be conducted at headquarters.

MILITARY SURGEONS' CONVENTION

The 45th annual convention of the Association of Military Surgeons will be held in Los Angeles, October 14-16, 1937. Headquarters will be at the Ambassador Hotel. Rear Admiral P. S. Rossiter, Surgeon General, United States Navy, is President of the Association and will deliver the presidential address. There will be a meeting of the executive council at 8 p. m. on October 13th and a business meeting of the Association at 9 a. m. on October 14th, and after the scientific program, October 16th. The scientific program follows:

THURSDAY, OCTOBER 14, OPENING SESSION

10:15 a. m.: Invocation. Address of welcome. Response. Addresses. President's address.

12:30 p. m. Ladies' luncheon.

1:30 p. m. Capt. George A. Cottle, M. C., United States Navy. "Fleet medicine." Discussion to be opened by Capt. Lester L. Pratt, Marine Corps, United States Navy.

2 p. m. Maj. J. S. Chase, M. C., United States Army, retired. "Eyes in aviation."

2:30 p. m. Lt. Col. I. H. Jones, Medical Reserve, United States Army. "Ears in aviation". (Motion picture showing research.)

3 p. m. Col. Charles Decker, United States Army (D. E. O.) retired. "The training of medical officers in a major war emergency".

FRIDAY, OCTOBER 15

10 a. m. Capt. Leroy Lowman, Medical Reserve, United States Army. (Advisory committee Warm Springs Foundation.) "Physiotherapy in the next war". (Slides.) Discussion to be opened by First Lt. Harold Dewey Barnard, Medical Reserves, United States Army.

10:30 a. m. Lt. Comdr. Albert G. Bower, MC-V (S), United States Naval Reserve. "Modern typhoid treatment". Discussion to be opened by Roy Fisk, M. D.

11 a. m. Capt. Lucius Johnson, M. C., United States Navy. "Hospital ships in the World War: Lessons to be learned from them". (Slides.) Discussion to be opened by Capt. George Cottle, M. C., United States Navy.

11:30 a. m. Lt. Albert Wineland, MC-V (S), United States Naval Reserve. "Anesthesia in shock". Discussion to be opened by Eldon Tice, M. D.

1:30 p. m. Lt. A. R. Behnke, M. C., United States Navy. "Submarine medicine". (Slides.)

2 p. m. Chairman's address. Lt. Comdr. Howard L. Updegraff, MC-V (S), United States Naval Reserve. "Emergency plastic surgery". (Motion Picture.)

2:30 p. m. Commander C. V. Rault, D. C., United States Navy. "The blood sedimentation rate in dental infections". (Slides.)

3 p. m. Commander Albert Soiland, MC-V, (S), United States Naval Reserve, retired, "The medical specialist's units, United States Naval Reserve".

SATURDAY, OCTOBER 16

10 a. m. Guest Speaker: Col. Howard Naffziger, Medical Reserve, United States Army. "Surgical treatment of low back pain". (Slides.)

Business meeting of the Association.

AMERICAN BOARD OF OTOLARYNGOLOGY

At the recent meeting of the Board of Otolaryngology, held in Atlantic City, it was moved and carried that men in active duty in United States Services (Army, Navy, and Public Health) be exempt from payment of \$50 application fee; however, such candidates are to pay \$10 for the certificate when informed they have passed the examination which is the same type of examination as is given to men in civilian practice.

THE HUMAN MACHINE IN DEEP-SEA DIVING¹

This article is a review of recent advances in our knowledge of physiology as applied to diving in depths exceeding 150 feet. The writer, from long experience, is particularly competent to write on this subject and he presents a very readable discussion of the many complicated factors involved. The article should materially clarify some of the personnel problems involved in deep-sea diving, and

¹ By Ernest W. Brown, Captain, Medical Corps, United States Navy, and published in the United States Naval Institute Proceedings for June 1937.

dissemination of this knowledge should prove of timely interest to the service.

The writer comments on the psychological response of personnel under increased pressure and makes particular reference to the interesting work reported by Behnke. He also comments on the research work reported by the second deep-diving committee of the Admiralty, including illustrations and discussion of the function of the Davis submersible decompression chamber. This is cylindrical in form, with doors at each end which permit it to serve as either a diving bell or decompression chamber, and it is large enough to accommodate the diver and his attendant. It can be lowered to the 60-foot stage, receive the diver, place him under compression, then proceed with decompression at leisure, thus materially shortening the period of exposure of the diver to the chilling effect of the water. The work of this committee demonstrated the necessity of new decompression tables. The committee was also able to shorten the period of descent by adding to the diver's equipment a canister of CO_2 absorbent. Gas substitutes for natural air, such as increased percentages of oxygen and nitrogen, and helium oxygen, are discussed. This work is still in an experimental stage. The illustrations accompanying this article are excellent.

PERCENTAGE SOLUTIONS

There has been so little uniformity in the interpretation of the meaning of percentage solution that the committee of revision has included a definition of this term in the recently issued Eleventh Revision of the Pharmacopoeia of the United States of America. This definition is as follows:

Percent solutions.—In connection with solutions, percent or percentage has different meanings under different circumstances as follows:

Percent or percentage, "weight in weight" (w/w) expresses the number of grams of an active ingredient in 100 grams of the solution.

Percent or percentage, "weight in volume" (w/v) expresses the number of grams of an active ingredient in 100 cubic centimeters of the solution.

Percent or percentage, "volume in volume" (v/v) expresses the number of cubic centimeters of an active ingredient in 100 cubic centimeters of the solution.

In the dispensing of prescriptions, slight changes in volume due to variations in room temperature and the trifling difference between the volumes of the cubic centimeter and the milliliter are negligible and may be disregarded. When the expression "percent" is used in prescriptions without qualification, it is to be interpreted to mean: For solutions of solids in liquids, percent, weight in volume; for solutions of liquids in liquids, percent, volume in volume; and for solutions of gases in liquids, percent, weight in volume. For example, a 1 percent solution is prepared by dissolving 1 gram of a solid or

1 cubic centimeter of a liquid in sufficient of the solvent to make 100 cubic centimeters of the solution. A solution of the same strength may be prepared by apothecaries weight and measure by dissolving 4.5 grains (more accurately 4.5457 grains, at 25° C.) of a solid or 4.8 minims of a liquid in sufficient of the solvent to make 1 fluid ounce of the solution.

INFLUENZA¹

This is a progress report of the investigations on influenza at H. M. National Institute for Medical Research, by Sir Patrick Laidlaw, Dr. Andrewes, Dr. Wilson Smith, and Dr. Stuart-Harris. These investigators have been concerned with the transmission of the infectious agent of influenza from man to ferrets and from ferrets to mice. Their previous work has indicated that this infectious agent is an ultra-microscopical virus. The current report is concerned with three phases of the research.

The world-wide diffusion of the virus originally isolated and identified at the National Institute: Comparison of this virus with that isolated from patients suffering from typical influenza in England, Puerto Rico, Philadelphia, Alaska, Australia, Holland, and European Russia would indicate that this is an identical virus and that this virus is the primary infective agent of epidemic influenza in man.

The transmission of ferret influenza to man: Prior to current report complete proof that this virus is the cause of influenza was lacking in that man had not been infected by virus obtained from experimental animals, even though this had been repeatedly attempted. During this investigation, one of the investigators, while working with a batch of influenza-infected ferrets, had one sneeze violently in his face. Forty-five hours later he developed a typical attack of influenza. This reached its climax on the third day. Prior to infection, this investigator was known to have had no immune bodies in his serum for this virus. These antibodies began to appear during the course of his infection, and by the eighth day they were strongly developed, increasing to the thirty-first day when they began to decline. Washings from the nasopharynx, up to the fourth day of his disease, were directly infective to ferrets. They were also infective for mice, which is the first reported instance of direct infection from the human to mice. This experimental work would seem to present the final evidence necessary in proof that this virus is the infective factor in influenza.

The possibility of immunizing man against influenza: Substantial progress is reported in this phase of the work. By successive pas-

¹ Report of the Medical Research Council for the year 1935-36.

sages through mice, the virulence of the virus has been enhanced to a potency such that a dilution of 1 to 10 million is infective for mice. This virus can be rendered noninfective by treatment with formaldehyde, yet it retains its antigenic value. It is purified by selective ultrafiltration and has demonstrated substantial protective properties for mice. Its immunizing effect on man is being investigated and the investigators, while cautious, believe that there is ample justification for hope that it may prove of value.

The August issue of the American Journal of Medical Sciences reports an Investigation on Volunteers infected with the Influenza Virus at the Pasteur Institute in Leningrad. In this investigation 20 percent of 72 volunteers developed clinical and hematological changes conforming with a mild influenza when infected with large doses of virus. There was close correlation between the quantity of specific protecting antibodies present and susceptibility to infection. Individuals responding with clinical symptoms developed a large increase in protective antibodies. In passage through the mouse or ferret the virus seems to lose its virulence for man and its activation effect on potentially pathogenic micro-organisms, such as the pneumococcus, the hemolytic streptococcus, and Pfeiffer's bacillus. Further study is suggested of using this attenuated virus to decrease susceptibility of man to influenza infection.

DIGEST OF TREATMENT

J. B. Lippincott Co. are presenting to the profession a monthly periodical of the format of the Reader's Digest. The first issue appeared in July. A competent staff of medical specialists presents a condensed review of the current medical literature. The first issue is limited to 80 pages and includes 34 reviews. This issue would indicate that the editorial staff is particularly interested in disseminating information from less generally read periodicals.

Dr. Lewellys F. Barker commends this publication particularly to the general practitioner. It should also be valuable to the specialist who desires to keep informed on developments in allied fields. If the editorial staff adheres to its present policy of reviewing current literature, consisting of more than 200 journals, and presenting brief and impartial reviews of worthy articles, their publication should prove very valuable and popular.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The EDITOR,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.
(For review.)

WHO GAVE THE WORLD SYPHILIS? by *Richmond C. Holcomb, Captain, Medical Corps, United States Navy, retired.* 189 pages. No illustrations. The Froben Press: New York. 1935. Price \$3.50.

This book has an interesting introduction by Rear Admiral C. S. Butler, Medical Corps, United States Navy, who tells how Captain Holcomb has made use of a reproduction of the only copy in the United States, that in the Huntington Library, of the work of Ruiz Diaz de Isla. This was published in 1539 and, of course, in Spanish relatively archaic as to construction of language. The work had to be translated entirely by Dr. Holcomb. The arduous labor required for this translation was in part repaid by the fact that he was obtaining first-hand information on his subject.

The theory of the American origin of syphilis is based apparently upon certain unfounded inferences and coincidences; for example, it appeared apparently in the European countries on an extensive scale a short time after the Columbian voyages, and the conclusion has been reached by many that therefore the disease originated in the Americas and was brought back to Europe after the discovery by Columbus. Real evidence that such is the case is lacking, and indeed there is almost certain evidence to show that the disease existed in Europe long before the discovery of the New World, but was not named and recognized as typically a venereal disease until about the beginning of the sixteenth century. It is a striking fact that in Europe during the middle ages there were estimated to be about 18,000 leprosaria and that leprosy therefore must have been rampant. Shortly after the Columbian voyages these leprosaria disappeared. Leprosy became a relatively uncommon disease, while syphilis became common. It seems more than likely that much of the medieval leprosy was syphilis or other skin conditions such as psoriasis, eczema,

and other diseases with marked skin lesions. In addition to the evidence obtained from a study of De Isla that syphilis was not of American origin, the work is of the greatest interest as showing the medical practice of the time, particularly in regard to current theories as to etiology of various pathological conditions and also their treatment.

Doctor Holcomb's whole book shows evidence of his scholarship and his ability as a research worker.

MODERN TREATMENT AND FORMULARY, by *Edward A. Mullen, P. D., M. D., Assistant Professor Pharmacology and Physiology, Philadelphia College of Pharmacy and Science, Lieutenant Commander, Medical Corps, United States Naval Reserve.* 707 pages. 1936. F. A. Davis, Company, Philadelphia. Price \$5.

A good formulary is one of the most useful books a physician can have and this one is of a particularly practical nature. Among other features are the sections of intravenous medication, formulae and doses for hypodermic medication, preparation of fluid foods, and diet lists; a table of differential diagnoses, dose table, a five-language physician's interpreter, a poison and antidote table, and many of those useful things to which we desire to refer such as a comparison of thermometer scales, conception periods, measurements of the female pelvis and uterus, the treatment of hemorrhage and wounds, the pulse at different ages, the respiration of different ages, chart of eruptive contagious diseases, and similar items so arranged and indexed as to be readily accessible. It is to be noted that Dr. Mullen is a member of the United States Naval Reserve.

DISEASES OF THE CORONARY ARTERIES AND CARDIAC PAEN, edited by *Robert L. Levy, M. D., Professor of Clinical Medicine, College of Physicians and Surgeons, Columbia University.* 445 pages, many illustrations. The Macmillan Company, New York. 1936. Price \$6.

Some day they will probably erect a monument to a man who did not die of coronary thrombosis but until that time (and as long as heart disease holds so prominent a place as a cause of death in civilized countries, books dealing with this particular field of heart disease must be on every doctor's desk.

This book, written by some of the most eminent cardiologists of the world, leaves little to be desired in comprehensiveness and excellence. Of particular importance is the chapter on the pharmacology of the coronary circulation. This provides the fundamental plan for the drug treatment. Another section of peculiar interest is that upon the statistics of the diseases of the coronary arteries by Louis I. Dublin. Another feature of the book is the attention devoted to the surgical treatment of these cardiac conditions.

HEART DISEASE, by *Paul D. White, M. D., Lecturer in Medicine, Harvard Medical School*. Second edition. 744 pages. 125 illustrations. The Macmillan Company, New York. 1937. Price \$7.50

This new edition represents a complete revision to cover all advances in cardiology. There are a number of new illustrations and the bibliography has been brought up to date. Of great interest are the two new appendices. One gives an historical sketch of cardiology, the other the classification of heart conditions approved by the American Heart Association.

ENDOCRINOLOGY, by *August A. Werner, M. D., F. A. C. P., Assistant Professor of Internal Medicine, St. Louis University School of Medicine*. 672 pages. 265 engravings. Lea & Febiger, Philadelphia. 1937. Price \$8.50

This is an excellent and compact work on an important yet difficult subject. Dr. Werner has displayed excellent judgment in distinguishing between the known and the merely conjectural fields. Features of special interest include studies of growth and of dentition in relation to the endocrines. Another feature are the excellent illustrations, most of which are entirely new. The author puts very well the importance of his subject when he says that "to be a good clinical endocrinologist one must first be a good internist, and the time is not far distant when, in order to be a good internist, one must be a good endocrinologist."

PRINCIPLES OF PHARMACY, by *Henry V. Arny, Ph. M., Ph. D., Dean and Professor of Chemistry in the College of Pharmacy of Columbia University*. Fourth edition. 1,139 pages. 294 illustrations. W. B. Saunders Company, Philadelphia and London. 1937. Price \$8

This valuable book was first published 27 years ago and has been a sure guide to a whole generation of pharmacists. The new fourth edition has been written to bring to the student the newest knowledge in regard to drugs today, and to include the changes necessary after the publication of the new editions of the United States Pharmacopoeia (U. S. P. XI) and the National Formulary (N. F. VI).

Arny's Pharmacy is an excellent teaching book, well planned and designed. The book is divided into six parts. The first part is concerned with pharmaceutical processes and appliances, the second with galenicals, the third and fourth parts with inorganic and organic chemicals, the fifth part with chemical testing, and the sixth part with dispensing. There is a valuable list of reference books and of important chemicals and pharmaceutical volumes. As may be expected, the book is beautifully made, well printed on fine paper, with many excellent illustrations. The index is particularly complete.

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PHYSICAL DIAGNOSIS, by *Ralph H. Major, M. D., Professor of Medicine in the University of Kansas.* 457 pages. 427 illustrations. W. B. Saunders Company, Philadelphia. 1937. Price \$5.

Dr. Major has purposely omitted from his book such subjects as roentgenology, electrocardiography, and laboratory tests of various kinds. In this way he has made the book purely a textbook of physical diagnosis. It is an excellent one, concise, well written, and well illustrated. There is a picture on nearly every page, a most valuable feature in a textbook.

Another fact of interest, he begins with an historical introduction and in his description of diseases he has often gone back to the older clinicians, guided to that method of describing signs and symptoms by the advice of Osler who said "And when you can read the original descriptions of the masters who, with crude methods of study, saw so clearly." It is a very practical book and should be of the greatest use both to the medical student and the practitioner.

THE ART OF COMPOUNDING, by *Wilbur L. Scoville, Master of Pharmacy and Doctor of Science, formerly Professor of Theory and Practice of Pharmacy in the Massachusetts College of Pharmacy, and Justin L. Powers, Ph. D., Assistant Professor of Pharmacy in the University of Michigan.* 620 pages. 61 illustrations. Sixth edition. P. Blakiston's Son & Company, Inc. Philadelphia. 1937. Price \$4.75.

This book was originally published long enough ago to make it now one of the classic textbooks of American pharmacy. The reviewer remembers well the third edition which appeared in 1904. The subtitle *A Text for Students and a Reference Book for Pharmacists at the Prescription Counter*, describes better than any introduction or any review the purpose of Dr. Scoville's book. It is an invaluable guide for the operative pharmacist. Of interest and importance are two new chapters, one on biological products and one on vitamins. There is a chapter on homeopathic pharmacy, and in the chapter on prescriptions is a valuable glossary of pharmaceutical Latin. There are more than 1,100 prescriptions included in the illustrative material.

UROLOGICAL ROENTGENOLOGY, by *Miley B. Wesson, M. D., Ex-President American Urological Association, and Howard E. Ruggles, M. D., Roentgenologist to University of California Hospital.* 269 pages. 227 engravings. Lea and Febiger, Philadelphia. 1936. Price \$5.

This is an elementary manual of urography and while primarily intended for internists and general practitioners, to assist them in interpreting urograms, it is also a book of the greatest value to urologists and roentgenologists. Fine illustrations and legends which amount to brief case histories accompanying them feature this text.

THE INTELLECTUAL FUNCTIONS OF THE FRONTAL LOBES, by *Richard M. Brickner, B. S., M. S., Assistant Professor of Neurology, College of Physicians and Surgeons.* 354 pages; illustrated. The Macmillan Company, New York. 1936. Price \$3.50.

This is a study based upon the observations of a man after a partial bilateral frontal lobectomy.

EUGENICAL STERILIZATION, by *The Committee of the American Neurological Association for the Investigation of Eugenical Sterilization.* 211 pages. The Macmillan Company, New York. 1936. Price \$3.

This committee was appointed to, and has attempted to, evaluate the facts and theories regarding the inheritance of crime, feeble-mindedness, apoplexy, and certain mentality diseases. The funds for this study were supplied by a grant from the Carnegie Foundation to the New York Academy of Medicine.

LABORATORY OUTLINE IN FILTERABLE VIRUSES, by *Roscoe R. Hyde, A. B., A. M., Ph. D., Professor of Immunology and Director of the Laboratories of Immunology and Filterable Viruses, Johns Hopkins University, and Raymond E. Gardner, Associate in Immunology.* 85 pages. The Macmillan Company, New York. 1937. Price \$1.50.

This is a useful little book on laboratory work in viruses, particularly the descriptions given of the mosaic diseases of plants.

DIETETICS FOR THE CLINICIAN, by *Milton Arlanden Bridges, B. S., M. D., F. A. C. P.* 1055 pages. 3rd edition. Lea & Febiger, Philadelphia. 1937. Price \$10.

This is a complete revision of this well-known book which has been almost entirely rewritten. There are now 300 diets and 900 menus. The book is a comprehensive and reliable work for the clinician as well as the nutritional expert.

APPLIED DIETETICS, by *Sanford Blum, M. D., Head of Department of Pediatrics, San Francisco Polyclinic and Post Graduate School.* 408 pages. F. A. Davis Company, Philadelphia. 1936. Price \$4.75.

In addition to outlining diets for the important diseases, including among other things a dietetic treatment which the author states has been used successfully in many cases of colitis, it follows what might be called the case system and gives the actual diets ordered for real cases in his practice. It also includes the dietary for infants and children. There is an interesting chapter on dietetic fads and fallacies which alone is worth the price of the book. There is a good index.

ORAL DIAGNOSIS AND TREATMENT PLANNING, edited by *Samuel Charles Miller, D. D. S., New York University College of Dentistry, and twenty-two contributors.* 620 pages, 562 illustrations, including 15 color plates. 1936. P. Blakiston's Son & Co., Inc., Philadelphia. Price \$7.50.

This is a manual devoted almost entirely to the diagnosis of dental diseases and is analogous to books on medical diagnosis in its

general character. It has an additional feature, not only the diagnosis, but as the title indicates, the plan of treatment to be outlined for each condition. It is therefore a most valuable and useful work.

A TEXT-BOOK OF OPERATIVE DENTISTRY, by *William Harper Owen McGehee*, D. D. S., M. D., *Professor of Operative Dentistry, New York University College of Dentistry*. 922 pages, 1,040 illustrations. 2nd edition. 1936. P. Blackiston's Son & Co., Philadelphia. Price \$10.

This is the second edition, completely revised, of a well-known and valuable text on operative dentistry. Many beautiful illustrations feature this book. The binding is remarkably sturdy, water-resisting, and vermin-proof.

ALLERGIC DISEASES, by *Ray M. Balyeat*, M. D., *Associate Professor of Medicine, University of Oklahoma Medical School*, and *Ralph Bowen*, M. D. 516 pages; 132 engravings, including 8 in colors. 4th edition. 1936. F. A. Davis Company, Philadelphia. Price \$6.

This is a new edition, considerably revised and enlarged, of one of the best small books on the subject of allergic diseases. In addition to the careful consideration given to pollens, such subjects as animal emanations, cosmetics, fungi, insects, gusts, and fumes, are covered. Gastrointestinal allergy, allergic dermatoses, migraine are considered. The subject of treatment is given a relatively greater proportion of space than in most books of this size on allergy, and such things as diets are given in more detail.

PHYSICAL THERAPEUTIC METHODS IN OTOLARYNGOLOGY, by *Abraham R. Hollender*, M. D., F. A. C. S., *Associate in Laryngology, Rhinology, and Otology, University of Illinois College of Medicine*. 442 pages; 189 illustrations. The C. V. Mosby Company, St. Louis. 1937. Price \$5.

The increased interest in electric surgical tonsillectomy, in vasomotor rhinitis, and in medical diathermy makes this book a very timely one. It touches these subjects and indeed all other therapeutics used in otolaryngology in an excellent manner. There is a practical little glossary on the subject included. Another useful chapter is one on hearing aids.

AN INTRODUCTION TO COMPARATIVE BIOCHEMISTRY, by *Ernest Baldwin*, B. A., Ph. D., *Fellow of St. John's College, Cambridge*, with a foreword by *Professor Sir Frederick Gowland Hopkins*, F. R. S. 112 pages. The Macmillan Company, New York. 1937. Price \$1.50.

This illustrated manual presents an excellent résumé on the subject.

SYNOPSIS OF ANO-RECTAL DISEASES, by *Louis J. Hirschman*, M. D., F. A. C. S., *Ex-Vice President, A. M. A.* 288 pages; 175 illustrations and 6 color plates. The C. V. Mosby Company, St. Louis. 1937. Price \$3.50.

A most valuable and well illustrated little manual of the subject.

BRIGHT'S DISEASE AND ARTERIAL HYPERTENSION, by *Willard J. Stone, B. Sc., M. D., F. A. C. P., Clinical Professor of Medicine, School of Medicine, University of Southern California.* 352 pages; illustrated. W. B. Saunders Company, Philadelphia. 1936. Price \$5.

We have here a complete and thorough monograph. A feature is an interesting synopsis covering all the features of each type. There is an excellent historical introduction and this feature is continued through the book. An appendix of autopsy abstracts also adds much to the value of the monograph.

OCULAR THERAPEUTICS, by *Sanford R. Gifford, M. A., M. D., Professor of Ophthalmology at Northwestern University Medical School.* 341 pages, 60 engravings. Second edition, 1937. Lea & Febiger, Philadelphia. \$3.75.

Dr. Gifford has in concise form all the important treatment measures necessary in ophthalmology. Additions to this revision includes the use of vitamins and glandular extracts, heat and cold, and other physical agents. The chapter on glaucoma is remarkable for its common-sense dealing with this difficult subject.

MANUAL OF BIOLOGICAL ASSAYING, by *James C. Munch, M. D., Ph. D., Professor of Pharmacology and Bioassays, Temple University.* 180 pages. Paper bound. 1937. J. B. Lippincott, Philadelphia. \$2.

An extremely well planned laboratory manual of bioassay.

ESSENTIALS OF ELECTROCARDIOGRAPHY, by *Richard Ashman, Ph. D., and Edgar Hull, M. D.* 212 pages, illustrated. 1937. The Macmillan Co., New York. \$3.50.

Excellent and well illustrated summary of this important field of cardiology.

INHALATION ANESTHESIA, by *A. E. Guedel, M. D., Associate Clinical Professor of Surgery, University of Southern California School of Medicine.* 172 pages. The Macmillan Co., New York. 1937. \$2.50.

A brief survey of the essentials in regard to inhalation anesthesia with emphasis on anesthesia accidents, their prevention and treatment.

TEN MILLION AMERICANS HAVE IT, by *William Becker, M. S., M. D., Associate Professor of Dermatology and Syphilology, University of Chicago.* J. B. Lippincott Co., Philadelphia, Pa. Price \$1.35.

This little book of small format and 220 pages is a veritable God-send at this time for several reasons, any one of which would justify its publication.

It is a most timely treatise for the lay public at a period when the lay public has become so interested in the national antisiphilis campaign and is learning that syphilis constitutes a national health problem of enormous importance. Besides being a timely treatise, it is the only modern and authoritative one extant prepared for popu-

lar reading. It also should be of especial value and interest to the intelligent syphilitic patient who can find here the answers to hundreds of questions which his doctor lacks the time to answer. Even the medical profession, with the exception of those who have devoted their careers rather exclusively to this field of medicine, will find here an excellent education in syphilis, presented lucidly, authoritatively, honestly, and altogether admirably.

Having said these things in sincere praise of the book, this reviewer feels constrained to add two points of adverse criticism. In his chapter on the history of syphilis, the author is unable to resist the temptation of giving—as though the question were incontrovertibly settled forever—the highly romantic and very entertaining Columbian view of introduction of the disease into Europe. Of course, this historical controversy is of purely academic importance and interest, and, it is agreed, the Columbian idea does make by far the more readable story of the two. The author, however, without spoiling one bit the punch of the story, might easily have added, as an after thought, that it is nothing more than a hypothesis, that the controversy will probably never be settled, and that such a recognized supreme authority as Sudhoff or so profound an historical student as C. S. Butler have presented far more convincing evidence in support of the pre-Columbian view.

The second criticism concerns the author's comment on extra genital syphilitic infection among certain Bedouin tribes of Arabia. The writings of E. H. Hudson on yaws in these same tribes and the writings by P. W. Wilson on yaws in Haiti and Panama suggest that the 66 percent incidence he mentions is for the disease that Hudson and Wilson call "yaws", known as "bejel" in Arabia and "pian" in Haiti. This condition exists in Haiti and some of the Pacific Islands where the incidence is not 66 percent but 90 percent. Apparently the author either adheres to the theory that these two conditions are identical in etiology or else he has inadvertently confused yaws with syphilis.

TAYLOR'S PRACTICE OF MEDICINE. *Poulton.* 15th edition, William Wood & Co., Baltimore. 1936. Price \$8.50.

It has long been a mooted point in medical pedagogy whether it is better for the author of a textbook for students to write the entire text or to have an expert write each principal subject, the editor looking after the matter of overlapping. Osler's *The Principles and Practice of Medicine*, as revised by McCrae in the twelfth edition (1935) with its 1,155 pages, is an example of the former, while the third edition of Cecil (1933) with its 1,584 pages and 156 contributors is an example of the latter.

In the fifteenth edition of Taylor's Practice of Medicine, six physicians, each an authority upon the particular subjects about which he writes, have collaborated. The text covers a wider field than is usually covered in a Practice of Medicine in that diseases of the skin, mental diseases, tropical diseases, and diseases of the nose, throat, and ear are given formal consideration in special divisions of the volume. This reviewer believes that for the busy medical student of the twentieth century, this third method of giving an accurate understanding of so complex a subject is the best. This edition has 1,114 pages of text and there are 71 excellent plates, many of them in colors and each of basic value for instruction of the student. The index occupies 22 pages and is adequate. The references are sufficient in number to give the student the essential bibliography of each subject. The printing is easy upon the eyes and the whole volume is an example of modern bookmaking which leaves little to be desired.

In this review the many good points of this work cannot be detailed. The part on Diseases of the Tropics because of the novelty of inclusion in a manual of this type deserves a few words. Dr. N. Hamilton Fairley is an international authority on tropical diseases and his 130 pages give an adequate presentation of this subject for the general practitioner of the present day. Several formal treatises on tropical diseases of the present time cost more money than this whole volume and are worth less than Fairley's one section.

CLINICAL LABORATORY DIAGNOSIS, by Samuel A. Levinson, M. S., M. D., *Director of Laboratories, Research and Educational Hospitals, Chicago, Illinois; Associate Professor of Pathology and Bacteriology and Assistant Professor of Medicine, University of Illinois, College of Medicine;* and Robert P. MacFute, Ch. E., M. S., *Assistant Director of Laboratories, Research and Educational Hospitals, Chicago, Illinois; Associate in Pathology and Bacteriology and Instructor of Physiological Chemistry, University of Illinois, College of Medicine.* Cloth. Price, \$9.50. 877 pp., with 157 illustrations. Philadelphia: Lea & Febiger, 1937.

This excellent volume is based on an outline the authors distribute to their students at the University of Illinois, College of Medicine.

It reviews the fundamentals of anatomy, physiology, biochemistry, and clinical medicine and gives the approved technique of tests involving the entire gastrointestinal tract, metabolism, blood, urine, hematology, immunology, serology, spinal fluid, bacteriology, sputum, skin tests and other biological examinations, pediatric procedures, milk and water analysis, histological technique, legal medicine, and toxicology. Under the appendix, preparation of normal solutions, antidotes, normal weights of viscera, conversion factors. Under a special appendix an excellent outline is given for the teaching of clinical laboratory diagnosis.

This book is exceptionally well written, contains numerous well selected illustrations and plates. It is highly recommended for students, physicians, technicians, and instructors in clinical laboratory diagnosis.

NICARAGUA, by direction of the *Major General Commandant of the United States Marine Corps*, a board, of which *Maj. Julian C. Smith, United States Marine Corps*, was senior member, has issued a review *Of the Organization and Operations of the Guardia Nacional De Nicaragua*. This is an historical summary of the *Marine Corps' operations in Nicaragua for the period 1927 to 1932 insofar as they concern the Guardia Nacional*.

The review discusses in detail the organization and function of the Guardia, including military operations. During this period Medical Department personnel were detailed to the Guardia for service to Guardia personnel and to render essential humanitarian service to needy civilians. Similar to the policy with respect to line officers, the Medical Department trained civilian native personnel, which gradually took over the functions assigned to the Medical Department of the Guardia.

While serving with the Guardia, Hugo F. A. Baske, lieutenant commander, Medical Corps, United States Navy, was killed in the Managua earthquake in 1931, and Finis H. Whitehead, pharmacist's mate, first class, was killed in action at Abali in April 1932, for which they were placed on the Roll of Honor.

THE DIVISION OF PREVENTIVE MEDICINE

C. S. STEPHENSON, Commander, Medical Corps, United States Navy, in charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS AS ADMINISTERED IN THE UNITED STATES NAVY IN 1936 WITH SPECIAL REFERENCE TO ARSENICAL DERMATITIS

By C. S. STEPHENSON, Commander, Medical Corps, United States Navy, and E. H. WINGO, Chief Pharmacist's Mate, United States Navy

For the past 12 years medical officers of the Navy have been required to submit monthly reports to the Bureau of Medicine and Surgery of the number of doses of arsenicals administered and the reactions therefrom. This information, including that for 1935, has been compiled and published in the United States Naval Medical Bulletins of September 1925, January 1927, January 1929, July 1930, October 1931, October 1932, April 1933, October 1933, October 1934, January 1935, October 1935, January 1936, October 1936, and January 1937.

In table 1 are shown the number of doses of each arsenical administered in the year 1936, the reactions which occurred, and similar data for the 12-year period 1925-36. It is noted that in 1936 there was 1 reaction to 1,395 doses and 1 death to 35,347 doses. For the 12-year period 1925-36 there was 1 reaction to 1,301 doses and 1 death to 28,625 doses.

TABLE 1.—Arsenicals, U.S. Navy, 1936 and 1925-36—type of drug, reaction, and ratio of doses to reactions

	Number of doses administered	Reactions				Ratio of reactions to doses 1 to —	Ratio of deaths to doses 1 to —
		Mild	Severe	Fatal	Total		
Year 1936:							
Acetarsons.....	140	0	0	0	0	0	0
Arsphenamine.....	2,611	0	1	0	1	2,611	0
Bismarsen.....	409	0	0	0	0	0	0
Mapharsen.....	2,302	0	0	0	0	0	0
Neocarphenamine.....	92,907	46	21	3	70	1,327	30,969
Silver arsphenamine.....	75	0	0	0	0	0	0
Sulpharsphenamine.....	2,525	2	2	0	4	631	0
Tryparsamide.....	5,072	0	1	0	1	5,072	0
Total.....	106,041	48	25	3	76	1,395	35,347
12-year period 1925-36:							
Acetarsons ¹	945	0	0	0	0	0	0
Arsphenamine.....	39,712	27	14	1	42	945	39,712
Bismarsen ²	1,359	0	0	0	0	0	0
Mapharsen ³	2,875	0	0	0	0	0	0
Neocarphenamine.....	1,087,083	544	269	41	854	1,272	26,514
Silver arsphenamine ⁴	576	0	1	0	1	576	0
Sulpharsphenamine.....	25,037	16	8	0	24	1,043	0
Tryparsamide.....	44,674	2	1	0	3	14,891	0
Total.....	1,202,261	589	293	42	924	1,301	28,625

¹ First administered during the year 1932.

² First administered during the year 1929.

³ First administered during the year 1935.

⁴ First administered during the year 1931.

TABLE 2.—*Arsenical reactions, U. S. Navy, 1936*

Classification	Cases	Deaths	Classification	Cases	Deaths
Arsenical dermatitis.....	34	2	Hemorrhagic encephalitis.....	2	1
Vasomotor phenomena.....	29	0	Liver damage (jaundice).....	1	0
Blood dyscrasias.....	3	0	Optic neuritis.....	1	0
Jarisch-Herxheimer.....	4	0	Total.....	76	3
Gastrointestinal.....	2	0			

From table 2 it may be seen that the most frequent reactions are those that are classified as arsenical dermatitis and vasomotor phenomena. Dermatitis in some form was observed in 44.74 percent of the cases. In 1935 dermatitis in some form was observed in 37.38 percent of the cases.

TABLE 3.—*Proportion of reactions of various types, 1929-36*

Classification	Number of reactions	Percent of total reactions
Vasomotor phenomena.....	313	45.49
Arsenical dermatitis.....	235	34.16
Blood dyscrasias.....	31	4.51
Table reactions.....	26	3.78
Liver damage.....	25	3.63
Reactions of minor importance.....	17	2.47
Jarisch-Herxheimer.....	16	2.33
Gastrointestinal.....	11	1.60
Hemorrhagic encephalitis.....	6	.87
Arsenical neuritis.....	2	.29
Optic neuritis.....	2	.29
Acute renal damage.....	1	.15
Border line, hemorrhagic encephalitis.....	1	.15
Liver damage (doubtful reaction).....	1	.15
Vascular damage (probable adrenal hemorrhage).....	1	.15
Total.....	688	100.00

In this article will appear a brief summary of the clinical history of each of the 34 cases of arsenical dermatitis.

ARSENICAL DERMATITIS

The 34 cases of arsenical dermatitis reported in 1936 were classified as 14 mild, 18 severe, and 2 fatal reactions. The type of lesion was exfoliative in 19 instances, erythematous in 7, urticarial in 3, masclar in 3, and fixed exanthem in 2.

MILD REACTIONS

The 14 mild reactions occurred after the following number of injections: 2 after the first injection, 3 after the second, 3 after the third, and 1 each after the eighth, tenth, twelfth, fourteenth, forty-third, and seventy-fourth.

The interval between injection and appearance of symptoms varied from 10 minutes to 6 days.

The length of time required for recovery varied from 30 minutes to 12 days.

A brief history of each case is cited.

NEOARSPHENAMINE

(1—1936.) This patient reported to the sick bay January 2, 1936, complaining of sore throat, headache, and fever. Examination revealed inflamed tonsils, covered with a dirty membrane, and injected pharynx. A direct smear from the throat showed enormous numbers of Vincent's organisms. The throat was swabbed with a 10 percent solution of neoarsphenamine and glycerin, and a 0.3-gram injection of neoarsphenamine was administered. Twenty-four hours after the injection of neoarsphenamine the patient developed a mildly edematous condition of the skin, especially marked on the forearms, thighs, and genitals. This condition was followed in a few hours by an itching, scaly, desquamating rash, involving practically the entire body. The throat condition cleared rapidly. He was given 1 gram of sodium thiosulphate intravenously daily, for 5 days. Recovery in 5 days.

(2—1936.) A patient who was exposed on September 6, 1935, developed a lesion on the glans penis which was positive for *Treponema pallidum*. From September 24, 1935, to January 10, 1936, he received 11 injections of neoarsphenamine, a total of 4.95 grams, and 9 intramuscular injections of bismosol as concurrent treatment. The second course of arsenical treatment began January 4, 1936, with a 0.45-gram injection of neoarsphenamine. Ten minutes after the injection the patient became nauseated and vomited. An urticarial rash appeared over the flexor surfaces of the arms and axillae. He received 1 cubic centimeter of adrenalin subcutaneously, and 1 gram of sodium thiosulphate intravenously. Recovery in 30 minutes.

(3—1936.) This patient was exposed to infection in December 1932. A darkfield examination of a lesion on the penis was negative for *Treponema pallidum*. The ulcer under treatment healed in 15 days. He was given a diagnosis of syphilis on March 28, 1933, because of repeated 4-plus Kahn blood tests and a history of the primary lesion. Between April 1933 and October 1935, he received 40 injections of neoarsphenamine, a total of 22.65 grams and 18 intramuscular injections of bismuth compounds and 8 injections of mercury as concurrent treatment. The eighth course of arsenical treatment began January 7, 1936, with a 0.35-gram injection of neoarsphenamine, and the patient was admitted to a naval hospital for a spinal fluid test on January 13. Physical examination at this time revealed a circumscribed itching and oozing plaque about 1½ inches in diameter on the right forearm, of about 2 weeks' duration. A patch test was negative. Appropriate X-ray and ammoniated mercury ointment were applied. Arsenical treatment was continued and on January 14 and 21 he was given 0.7 gram of neoarsphenamine without symptoms of a reaction. Six days after the injection administered on January 21 the patient developed a mild erythematous skin rash in the cubical fossae and popliteal spaces extending around and over the knees. He was given 0.5-gram of sodium thiosulphate intravenously. Recovery in 4 days. Examination at a later date revealed the plaque of pyoderma to be smooth, red, and slightly elevated without oozing or crusting.

(4—1936.) A patient, exposed to infection January 11, 1936, developed a lesion on the penis which was positive for *Treponema pallidum*. He was given a 0.3-gram injection of neoarsphenamine on February 4, 1936, and 0.45-gram injections on February 17 and 20. The patient received a total of 1.2 grams of neoarsphenamine within 6 days, an average of 200 milligrams per day. Four days after the last injection an examination showed generalized erythema and a temperature of 99.6° F. The patient stated that 2 days after the last injection he developed a slight chill followed by a hot sensation, which subsided

in a few hours. The patient had no subjective symptoms and the rash soon disappeared. Recovery in 7 days.

(5—1936.) This patient was given a diagnosis of syphilis because of generalized adenopathy and a typical indurated lesion on the glans penis. He received 13 injections of salvarsan between November 2, 1925, and July 28, 1926; 12 injections of sulpharsphenamine during the year 1928; and 9 injections of neoarsphenamine from September 25, 1935, to January 1, 1936. The tenth course of arsenical treatment began March 26, 1936, with a 0.3-gram injection of neoarsphenamine, followed by 0.45 gram on April 2. Moderate chill and a choking sensation developed 45 minutes after the last injection and examination revealed a generalized bran-like desquamating skin, which developed into a mild erythema involving the neck, shoulders, and trunk. The patient stated that his skin had always been dry and scaly, which lead to the assumption of a congenital ichthyosis. He was given 0.4 gram of adrenalin subcutaneously, and one gram of sodium thiosulphate intravenously. Recovery in 8 days.

(6—1936.) Following exposure on April 3, 1936, this patient developed an indurated lesion on the penis which was positive for *Treponema pallidum*. From April 9 to June 18, 1936, he received 10 injections of neoarsphenamine, a total of 7.5 grams, and 10 intramuscular injections of bismuth salicylate as concurrent treatment. The second course of arsenical treatment began June 25, 1936, with a 0.3 gram injection of neoarsphenamine, followed by 0.6 gram July 2. Twenty-three hours after the last injection the patient developed a generalized macular rash which began to fade within 12 hours. Recovery in 2 days.

(7—1936.) The source of infection in this case is unknown. The patient stated that he had several sores on the penis in 1926. A diagnosis of syphilis was made because of generalized adenopathy, repeated 4-plus Kahn blood tests, and four old scars on the penis. Arsenical treatment began with a 0.3-gram injection of neoarsphenamine administered April 21, 1936, followed by 0.6 gram April 25. The patient noticed a rash on the arms and over the trunk on April 28, but did not report this condition until the following day, when he complained of headache, sore throat, and fever. Examination revealed: A diffuse bright red rash on the face, forearms, and trunk; conjunctivitis, both eyes; moderate congestion of the throat; temperature, 102.4° F.; pulse, 122; and respirations, 20. One gram of sodium thiosulphate was administered intravenously on May 5, the rash clearing completely within 6 hours, and 1 gram on May 6, 7, 8, and 9, 1936. Recovery in 12 days.

(8, 9—1936.) This patient experienced two mild arsenical dermatitis reactions during the first course of arsenical treatment. Twenty days after exposure to infection a sore developed on the penis which was positive for *Treponema pallidum*. Arsenical treatment began June 1, 1936, with a 0.3-gram injection of neoarsphenamine, followed by 0.45 gram on June 5. Four hours after the second injection the patient complained of sore throat and fever. Examination revealed: Marked pharyngitis; redness of the tonsillar fossae; temperature, 102.4° F.; pulse, 122; and respirations, 20; and an erythematous rash over the chest, abdomen, and back; white blood count, 17,500; polymorphonuclears, 85; small lymphocytes, 12; large lymphocytes, 2; and eosinophiles, 1. One gram of sodium thiosulphate was administered intravenously. The rash disappeared and his temperature returned to normal. Recovery in 3 days. Arsenical treatment was continued and the patient received a 0.6 gram injection of neoarsphenamine June 16, 1936. Two hours after this injection an erythematous rash appeared; temperature was 102° F.; white blood count, 16,500; polymorphonuclears, 83; small lymphocytes, 13; large lymphocytes, 3; eosinophiles, 1. One gram of sodium thiosulphate was administered daily for 7 days. Recovery in 10 days.

(10—1936.) After exposure to infection, this patient developed a small lesion on the glans penis which was positive for *Treponema pallidum*. Arsenical treatment began on August 18, 1936, with a 0.45-gram injection of neoarsphenamine, followed by 0.45-gram injection on August 21 and 0.6-gram injection on August 26. He was given 0.1 gram of bismosol intramuscularly August 22. Eighteen hours after the last injection of neoarsphenamine the patient developed chills and fever with flushing of the face and neck. He received 1 gram of sodium thiosulphate intravenously. His temperature rose to 104° F. and a fine bluish macular rash appeared on the trunk and extremities. The rash began to fade the following day and the temperature gradually returned to normal. Recovery in 5 days.

(11—1936.) The source of infection in this case is unknown. The patient (supernumerary female, native of Guam) was given a diagnosis of syphilis because of an ulcerative lesion on the cervix-uteri and repeated 4-plus Kahn blood tests. Treatment began on June 19, 1936, with a 0.15-gram injection of neoarsphenamine followed by 0.25 gram on June 25, 0.4 gram on July 2, 0.5 gram on July 9, 0.25 gram on July 23, and 0.5-gram injections on August 6, 20, and 27. Two intramuscular injections of bismuth salicylate and one injection of bismosol were administered as concurrent treatment. Five hours after the last injection of neoarsphenamine, the patient was admitted, unconscious, marked difficulty in breathing, respiratory rate below normal, excursions deep, and movements labored. A slight amount of frothy sputum was present on the lips. She was given 15 minims of adrenalin hypodermically and 1 gram of sodium thiosulphate intravenously. Recovery in 48 hours.

(12—1936.) A patient who was exposed to infection December 1, 1936, developed a small ulcer on the penis on December 10 which was positive for *Treponema pallidum*. He was given 0.3 gram of neoarsphenamine on December 11, followed by 0.45 gram on December 17. Thirty hours after the last injection he reported severe itching of the skin. Examination showed several red patches over the body, followed by large urticarial wheals over the body and arms. He was given 1 gram of sodium thiosulphate intravenously, and three-eighths grain of ephedrine hydrochloride by mouth every 4 hours, for four doses. The rash and itching subsided by December 21, 1936, and the patient felt well. On December 23, 1936, he was given a test dose of 0.1 gram of neoarsphenamine dissolved in 5 cubic centimeters of distilled water and injected in 1 minute. Seven hours later he developed urticarial wheals and intense itching, which subsided in 2 days. Recovery in 9 days.

(13—1936.) This patient developed a small ulcer on the penis after exposure on July 1, 1936. Repeated darkfield examinations were negative for *Treponema pallidum* and Kahn blood tests made on August 10 and 17 were 4-plus. Arsenical treatment began on September 8 with a 0.35 gram injection of neoarsphenamine, followed by seven weekly 0.7-gram injections. As concurrent treatment he was given 12 intramuscular injections of bismuth salicylate. During the month of November 1936 he received six injections of bismuth salicylate. On December 8 the second course of arsenical treatment began with a 0.35 gram injection of neoarsphenamine, followed by a 0.7-gram injection on December 15. He received 0.13 gram of bismuth salicylate on December 4, 8, 11, 15, and 18. Four hours after the last injection of neoarsphenamine the patient reported an itching rash over the back and legs. The lesions consisted of small macules and papules and inflamed follicles on the back and midsurfaces of the calves and the medial aspect of the thighs. He was given 1 gram of sodium thiosulphate intravenously daily, for 8 days. Recovery in 9 days.

(14-1936.) This patient developed a chancre on the penis and a secondary skin rash following exposure on November 18, 1936. A Kahn blood test was 4-plus. He was given a 0.3-gram injection of neoarsphenamine on December 29 and 7 hours later developed chills, fever, and a temperature of 102.2° F. He was given 1 gram of sodium thiosulphate intravenously. The following day a generalized erythematous rash appeared accompanied by itching. A second one-gram injection of sodium thiosulphate was given. All constitutional symptoms subsided within 48 hours after onset. The rash persisted for 3 days after which the skin became dry and scaly. The patient was considered recovered in 12 days, but remained on the sick list under observation and treatment for syphilis with mapharsen and heavy metal compounds until January 22, 1937.

SEVERE REACTIONS

The 18 severe reactions occurred after the following number of injections: 1 after the first injection; 2 after the second; 1 after the third; 2 after the fourth; 4 after the eighth; 2 after the ninth; and 1 after the tenth, eleventh, seventeenth, twenty-eighth, thirty-second, and forty-fifth. The interval between the injection and appearance of symptoms varied from 40 minutes to 10 days. The length of time required for recovery varied from 11 days to 149 days. According to reports received in the Bureau for the month of May one case (no. 32) is still on the sick list.

ARSPHENAMINE

(15-1936.) This patient was exposed to infection during the month of November 1935 and developed a lesion on the penis and enlarged inguinal glands. A darkfield examination of the lesion was positive for *Treponema pallidum*. Arsenical treatment began with a 0.3-gram injection of arsphenamine on January 4, 1936, and a 0.4-gram injection January 11. About 9 hours after the last injection the patient complained of headache, chills, and fever. Two days after the injection a pink macular rash appeared on the palms of the hands and soles of the feet. Red blood count, 4,230,000; white blood count, 13,150; hemoglobin, 80 percent; band forms, 18; segmented, 38; lymphocytes, 36; eosinophiles, 2; basophiles, 2; and monocytes, 4. The rash developed into a severe dermatitis involving the hands and feet, followed by complete exfoliation of the skin on the palms and soles. Recovery in 20 days.

NEOARSPHENAMINE

(16-1936.) This patient was infected August 11, 1933, and 20 days later a typical lesion appeared on the glans penis which was positive for *Treponema pallidum*. From September 19, 1933, to July 12, 1934, he received 14 injections of neoarsphenamine, a total of 7.5 grams, and 31 intramuscular injections of mercury. About 12 hours after the last injection of neoarsphenamine the patient suffered a mild blood dyscrasias reaction. Recovery within 24 hours. (Case no. 113-1934, U. S. Naval Medical Bulletin, January 1935). Due to the possibility that the lesions were manifestations of arsenical retention, treatment with arsenicals was discontinued. Between October 18, 1934, and December 30, 1935, he received 47 injections of bismuth compounds and 34 injections of mercury. On January 7, 1936, he was given 0.03 gram of mapharsen intravenously, followed by 0.06 gram January 14. Both injections of mapharsen

were well borne. On January 21, 1936, it was considered safe to administer a 0.3-gram intravenous injection of neoarsphenamine. About 22 hours after the injection the patient developed six copper-colored and slightly raised spots, each about $1\frac{1}{4}$ centimeter in diameter; one on each scapula, one on the right shoulder, and the others over the arms. Within 24 hours the spots on the arms began to fade. There is an area of indurated red scaly skin in both popliteal spaces. He had no complaint other than moderate itching.

January 27: Red blood count, 4,450,000; white blood count, 10,000; hemoglobin, 80 percent; band forms, 3; segmented, 73; lymphocytes, 24. The lesions are fading and the patient feels well.

January 28: The patient was given a 0.1-gram intramuscular injection of sulpharsphenamine. Bright red itching lesions appeared the following day and faded gradually during the next 5 days.

February 4: He was given 0.2-gram of sulpharsphenamine. The following day the bright red lesions appeared with moderate itching. The patient has a macerated swollen right toe.

February 9: The lesions are fawn colored. There is no itching, vesiculation, or scaling. The toe is improving.

February 11: 0.1 gram of sulpharsphenamine administered. The following day, two lesions resulting from a previous injection of sulpharsphenamine did not change appearance. All other lesions are bright red and faded during the next 4 days.

February 18: 0.2-gram of sulpharsphenamine administered. The following day only three of the lesions became red, but not as red as previous lesions. The lesions promptly faded and the patient was allowed to be up and about.

February 25: He was given 0.3 gram of sulpharsphenamine. The following day the lesions appeared and gradually faded.

March 3: He was given 0.4 gram of sulpharsphenamine. The following day the lesions appeared, but in less degree than previously.

The skin lesions resembled fixed dermatosis of the macular type. They appeared about 20 hours after the injection of an arsenical, reached their height of redness in about 36 hours, and slowly faded. There was usually slight itching over the lesions for 20 to 48 hours after the injection. No vesiculation or scaling and no itching or stinging in other parts of the body was experienced. The size of the dose of arsenical did not appear to have any influence on the degree of redness or itching of the lesions. Several of the lesions which previously reacted, faded to light pigmented areas. It was believed that the patient could tolerate arsenicals. However, if itching, stinging of the skin, or eruption should occur on other parts of the body, or the present lesions become vesicular or scaly, arsenical treatment should be discontinued. Recovery in 45 days.

(17-1936.) After exposure on February 8, 1927, this patient developed a small indurated ulcer on the glans penis and inguinal adenopathy. A dark-field examination of the ulcer was positive for *Treponema pallidum*. During the year 1927 he was given 7 injections of salvarsan and 20 injections of mercury (date and amount not stated). From July 24, 1934, to November 19, 1935, he received 20 injections of neoarsphenamine, a total of 10.65 grams, and 21 injections of bismosol. The fifth course of arsenical treatment began January 21, 1936, with a 0.3-gram injection of neoarsphenamine. About 8 hours after the injection, and after eating the evening meal, the patient became nauseated, followed by abdominal cramps. Thirty hours after the injection a copper-colored rash appeared from the waist line to the neck, and on the arms to the elbows. The patient complained of moderate itching over the entire

body. Nausea and abdominal cramps followed each meal until after he received 1 gram of sodium thiosulphate intravenously on January 27, 1936. One gram of sodium thiosulphate was also given intravenously January 28, 29, and 30. A Dickens' test which was negative before he received the sodium thiosulphate, was strongly positive 3 hours after he received sodium thiosulphate on January 27 and 28, and since January 29. The rash developed into a severe exfoliative dermatitis which terminated in desquamation. Recovery in 33 days.

(18-1936.) This patient experienced two arsenical reactions during the first course of arsenical treatment; the first was a mild vasomotor phenomena reaction which will be described in a later bulletin. He was exposed to infection February 10, 1936, and developed several small abrasions on the shaft of the penis on February 16, and a macular rash over the abdomen and thighs on March 3. A Kahn blood test was 4-plus. From March 9 to March 26 he received three injections of neoarsphenamine, a total of 1.5 grams, and 6 injections of bismosol. On April 2, 9, and 16 he received 0.45-gram injections of neoarsphenamine, and on April 7 and 15, 0.2-gram injections of bismosol. One hour after the last injection of neoarsphenamine, and after eating dinner, he complained of chills and a numb-like sensation over the entire body, followed by nausea and vomiting. All symptoms disappeared within 6 hours. He received 0.2-gram of neoarsphenamine and 0.2-gram of bismosol on April 23, followed by 0.3-gram of neoarsphenamine on April 30. Four days after the last injection of neoarsphenamine the patient complained of a rash over the arms and shoulders and itching of the skin. He stated that 5 hours after the injection he had a dull headache and a feeling of malaise and anorexia, and that the rash had developed gradually during the 3 days. Examination showed slight injection of the eyes and throat; generalized adenopathy; and a maculo-papular rash which involved the face, neck, arms, and body. He had no complaint other than slight itching of the skin. The skin condition gradually developed into a severe exfoliative dermatitis which improved under treatment and terminated in desquamation. Recovery in 90 days.

(19-1936.) The source and date of infection in this case is indefinite. The patient denied any extramarital exposure to infection. He stated that his wife was under treatment for syphilis and her present condition antedated the appearance of his initial lesion. He was given a diagnosis of syphilis after repeated darkfield examinations of a large indurated lesion on the shaft of the penis were positive for *Treponema pallidum*. Arsenical treatment began on November 27, 1935, with a 0.2-gram injection of neoarsphenamine, followed by 0.45-gram injections on December 4, 11, 18, and 27, 1935, and January 3, 10, 19, and 23, 1936. Twenty-four hours after the last injection he complained of a rash on the arms and legs and severe itching of the skin. After close questioning, he stated that after the seventh and eighth injections of neoarsphenamine a fine rash appeared on the arms and legs, followed by moderate itching. After the eighth injection he received treatment for scabies. Twenty-four hours after the ninth injection the rash rapidly developed into a generalized skin eruption with edema and weeping lesions. He complained of headache, general disability, and severe itching of the skin.

February 3: The skin is dry and shedding bran-like flakes, the external ears, arms, and thighs weeping a thin amber colored fluid. There is a thin purulent discharge from the right external auditory canal. Marked edema of the face, lips, and neck. The cervical, epitrochlears, and inguinal glands are enlarged. Red blood count, 4,500,000; white blood count, 25,400; hemoglobin, 80 percent; band forms, 12; segmented, 66; lymphocytes, 12; basophiles, 4; monocytes, 6.

January 5: The skin condition is improving. About 4:30 p. m. the patient experienced difficulty in breathing and was mentally confused. Temperature was 101° F.; pulse, 96; and respirations, 28. He complains of a pain in the left side of the chest when he takes a deep breath.

February 8: The skin condition continues to improve. There are moist rales over the entire upper portion of the chest and X-ray examination shows definite evidence of lobar pneumonia. Diagnosis changed to pneumonia, lobar.

February 7: White blood count, 13,300; hemoglobin, 80 percent; band forms, 20; segmented, 63; lymphocytes, 15, and monocytes, 2. Urine examination shows 2-plus albumin. Temperature, pulse, and respirations remain the same.

February 8: Condition of patient unchanged. He is irrational at times and extremely noncooperative, making accurate examination impossible.

February 10: The skin and chest conditions show improvement.

February 17: Diagnosis changed to "poisoning, arsenical, acute." The skin condition shows typical exfoliative dermatitis which improved under symptomatic treatment. Recovery was retarded by multiple skin abscesses from secondary infections. Recovery in 90 days.

(20—1936.) The source of infection in this case is unknown. The patient was exposed to infection during the month of July 1935. On September 7, 1935, he noticed a small red pimple-like lesion on the abdomen. The lesion did not heal and 1 month later he reported to the sick bay for treatment. Examination showed a slight punched out indurated ulcer, about 1½ by 2½ centimeters in size, on the abdomen midway between the umbilicus and anterior superior iliac crest, which had the appearance of a typical chancre. The inguinal and epitrochlear glands were enlarged. A darkfield examination was positive for *Treponema pallidum* and a Kahn blood test was 4-plus. From October 8 to December 28, 1935, he was given 9 injections of neoarsphenamine, a total of 4 grams, and 20 injections of bismuth salicylate as concurrent treatment. The second course of arsenical treatment began with a 0.3-gram injection of neoarsphenamine on March 24, 1936, and a 0.45-gram injection on March 31. Twelve hours after the last injection the patient developed a generalized rash accompanied by itching. He was given 1 gram of sodium thiosulphate intravenously on April 1 and 3. The rash developed into a severe exfoliative dermatitis terminating in desquamation. Recovery in 18 days.

(21—1936.) This patient was exposed to infection January 3, 1936, and developed a lesion on the glans penis and generalized adenopathy. A darkfield examination was positive for *Treponema pallidum* and a Kahn blood test was 4-plus. From January 11 to February 11, 1936, he received six injections of neoarsphenamine, a total of 2.55 grams. The second course of arsenical treatment began on February 25, 1936, with a 0.225-gram injection of neoarsphenamine, followed by 0.45-gram injections on March 3, 11, 17, and 24. Six days after the last injection the patient complained of an itching rash over the entire body except the head. When questioned the patient stated that about 40 minutes after the last injection of neoarsphenamine he developed a slight chill followed by fever, which lasted about 30 minutes. The following day he noticed a generalized body rash accompanied by itching. He treated himself for several days with an ointment. Examination showed a generalized measles-like scaly rash tending to weep in the antecubital spaces. He was given 1 gram of sodium thiosulphate intravenously on March 31, April 1 and 3. Temperature was normal until April 6 when it rose to 101° F. after a chill and gradually returned to normal during the next 2 days. On April 17 he experienced another chill and a temperature of 101.5° F. Temperature returned to normal the following day. The skin condition gradually developed into a

severe exfoliative dermatitis, with edema of the face, legs, and feet. Desquamation followed weeping eczematous type of skin lesions, with the ulcers exuding a foul smelling purulent exudate. The patient's hair fell out gradually.

Blood picture

Date	Red blood count	White blood count	Hemoglobin	Poly-morpho-nuclears	Lympho-cytes	Eosino-philes	Transi-tionals	Baso-philes
Mar. 26, 1936.....	-----	20,000	-----	-----	-----	-----	-----	-----
Apr. 4, 1936.....	-----	20,400	-----	96	4	-----	-----	-----
Apr. 6, 1936.....	4,700,000	23,350	70	68	26	3	1	2
Apr. 7, 1936.....	-----	36,800	-----	58	38	4	-----	-----
Apr. 9, 1936.....	-----	18,950	-----	94	6	-----	-----	-----
Apr. 18, 1936.....	-----	21,500	80	93	5	2	-----	-----

The skin condition gradually improved under careful treatment, the hair gradually growing again, and he gained in strength and weight. Recovery in 45 days.

(22-1936.) The source of infection in this case is unknown. The patient (supernumerary, U. S. Army) was given a diagnosis of syphilis because of repeated 4-plus Kahn blood tests. Antiluetic treatment was instituted and between November 17, 1934, and February 4, 1935, he received 20 intramuscular injections of bismuth salicylate. Arsenical treatment began February 14, 1935, with a 0.3-gram injection of neoarsphenamine, followed by a 0.6-gram injection on February 21. After the second injection of neoarsphenamine the patient developed two red spots on the side of his right leg. A patch test was negative. Arsenical treatment was continued and between February 28 and March 28 he received five injections of neoarsphenamine, 0.6-gram each, without affecting the spots.

From April 22 to July 30 he received 14 intramuscular injections of bismuth salicylate; from November 5 to December 17, 7 injections of neoarsphenamine, a total of 4.55 grams; and from December 17, 1935, to January 31, 1936, 9 injections of bismuth salicylate.

On February 25, 1936, the third course of arsenical treatment began with a 0.7-gram injection of neoarsphenamine, followed by 0.7-gram injections on March 10, 17, and 24. Examination on March 31, when the patient reported for the fifth injection of neoarsphenamine, showed the spots on the right leg to be about 4 inches in diameter, red, elevated, and itching. Three other plaques about 1 inch in diameter were present, one in the right inguinal crest, one on the lower left chest, and one on the back. These plaques were surrounded by red itching spots. The spots in the right inguinal crest and on the leg are fading with epidermal crust, but satellite spots now cover nearly the entire trunk. The dermatologist was of the opinion that the spots on the leg were a fixed arsenical eruption and the remainder of plaques pityriasis rosea. The patient was given fourteen 1-gram intravenous injections of sodium thiosulphate between April 1 and 30. The pityriasis rosea faded rapidly and the arsenical dermatitis on the right leg became a pink area. Recovery in 71 days.

(23-1936.) This patient was exposed to infection November 4, 1935. Nine days later a small lesion on the glans penis was negative for *Treponema pallidum*. On February 24, 1936, he complained of a rash over the entire body, and examination revealed a generalized macular eruption of the skin; generalized adenopathy; beginning mucous patches in the mouth; and a 4-plus Kahn blood test. Arsenical treatment was instituted February 27, 1936, with a

0.45-gram injection of neoarsphenamine, followed by 11 weekly injections, 0.9-gram each. He received a total of 10.35 grams of neoarsphenamine between February 27 and May 12, an average of 138 milligrams per day. As concurrent treatment daily mercury inunctions were given from March 23 to May 12. Twenty-four hours after the ninth injection of neoarsphenamine the patient noticed that his arms and legs were red and indurated. He did not report this condition and arsenical treatment was continued. Six days after the last injection the patient complained of redness of the skin and severe itching. Examination showed the skin to be dry and indurated, with generalized marked redness of the extensor surface. He was given 1 gram of sodium thiosulphate intravenously, May 18, 19, and 21. The rash gradually developed into a generalized severe exfoliative dermatitis over the entire body, with oozing and crusting, followed by desquamation. Recovery in 23 days.

(24-1936.) A patient who was exposed on December 14 and 21, 1935, developed a lesion on the glans penis which was positive for *Treponema pallidum*. A Kahn blood test was 2-plus. Antiluetic treatment began December 29, 1935, with 0.13 gram of bismuth salicylate given intramuscularly. On December 30 he received a 0.3-gram injection of neoarsphenamine, followed by 0.45-gram injections on January 2, 8, 15, 22, 29, and February 5 and 12, 1936. The patient stated that 10 days after the last injection he noticed slight itching of the face, which did not bother him much until 2 days later. He reported for treatment for what he thought was sun or wind burn. Examination showed marked edema of the forehead, eyes, and cheeks. Temperature, 103.5° F.; pulse, 120; and respirations, 20. The skin of the face is the color of a first-degree burn. No other symptoms.

February 25: White and differential blood count—leukocytes, 12,600; neutrophils, 45; lymphocytes, 19; large mononuclears, 2; transitional, 1; eosinophiles, 3; band forms, 30.

February 27: Blood count—erythrocytes, 4,096,000; leukocytes, 7,800; neutrophils, 17; large mononuclears, 1; eosinophiles, 8; mast cells, 1; band cells, 61.

March 9: Edema of the hands to the wrists, followed by vesicles on the palms spreading to the ventral surfaces of all fingers.

March 11: Hemorrhagic rash over the body and legs, more marked on the region of the chest and anterior region of the legs. The rash did not disappear on pressure.

March 19: Blood count—leukocytes, 12,500; neutrophils, 9; lymphocytes, 33; large mononuclear, 1; transitionals, 10; band cells, 43.

March 21: The inguinal and axillary glands are enlarged and several in each region ruptured and a thick serum was discharged in the course of 2 weeks. The skin of the hands and fingers is peeling; the hair of the head, face, body, and inguinal region is gradually falling out; and the nails are loosening.

March 28: The feet and ankles developed a pitting edema which reached its maximum swelling in 4 days and peeled as the hands did a week before.

March 30: The patient's neck and body began to peel and continued until April 5, by which time the hemorrhagic rash disappeared and desquamation ceased.

The patient weighed 152 pounds upon admission on February 24 and 104 pounds on April 12. The loss of weight was gradual and was accompanied by anorexia and diarrhoea between March 28 and April 20. There were eight and nine stools a day containing large amounts of mucus and undigested food. There was no itching of the skin and no pain during the course of his illness. His condition gradually improved. The hair and nails reappeared and he gained weight. Recovery in 65 days.

(25—1936.) A patient who was infected in April 1936 developed several ulcers on the penis which were positive for *Treponema pallidum*. A Kahn blood test was 3-plus. Arsenical treatment began April 20, 1936, with 0.2 gram of neoarsphenamine, followed by 0.3 gram May 2, and 0.45-gram injections May 6 and 11. One hour after the last injection the patient developed slight transitory edema of the lips. He had no other complaint. Arsenical treatment was continued and he was given 0.3 gram of neoarsphenamine on May 18 and 0.45 gram on May 26. As concurrent treatment he received eight injections of bismosol.

On June 1, 1936, the patient reported for the seventh injection of neoarsphenamine. He stated that a dry itching rash appeared on the arms 12 hours after the last injection of neoarsphenamine. Examination showed a slight rash over the flexor surfaces of the forearms. He was given 1 gram of sodium thiosulphate intravenously on June 1, 2, 3, 4, and 5.

June 5: The lesions have spread gradually to the trunk and legs.

June 7: The lesions on the forearms have developed into an edematous, oozing dermatitis. The patient complains of general weakness and moderate chilling. Temperature ranges from 99° F. to 100.2° F.

June 9: There is a raised, partially confluent rash over the entire body. The arms, hands, legs, and feet are edematous. There are vesicles between the fingers and large blebs on the feet. General oozing of entire area. Temperature around 100° F.

June 12: Marked edema of the face and eyelids, with a purulent discharge from the right eye. Temperature remains around 100° F.

June 17: The patient feels fairly comfortable. The legs and feet are edematous. There is desquamation of the skin over the entire body with some crusts from the general oozing.

The skin condition gradually improved and the patient returned to duty after 73 days on the sick list.

(26—1936.) Patient was infected on February 6, 1936, developed a lesion on the glans penis and generalized adenopathy. A darkfield examination on the lesion was positive for *Treponema pallidum* and a Kahn blood test was 4-plus. Arsenical treatment began with a 0.3-gram injection of neoarsphenamine on March 12, 1936, followed by 0.6-gram injections on March 19, 26, April 2, 9, 16, 23, and 30. Eight injections of bismuth salicylate were given as concurrent treatment.

On May 3, 3 days after the last injection of neoarsphenamine, the patient complained of a rash on the arms and legs, and examination revealed a rash similar to poison ivy. He was given local treatment with calamine lotion and soda baths. He had noted a slight rash over the arms and legs the day following the last injection of neoarsphenamine, but this caused no discomfort. The patient failed to return for further treatment until May 11. Examination at this time showed a generalized exfoliative dermatitis, the original area over the arms and legs being crusted and desquamating. White blood count, 17,400; segmented, 50; band forms, 8; lymphocytes, 22; and eosinophiles, 19. The patient was given 15 intravenous injections of sodium thiosulphate, 1 gram each, between May 15 and June 5. His condition gradually improved and he was returned to duty 55 days after onset of the first symptoms.

(27—1936.) This patient was under treatment for Vincent's angina, and was given a diagnosis of syphilis because of clinical and serological findings. The source and date of infection is unknown. The patient stated he had a small sore on the penis in April 1935, which healed promptly without treat-

ment. Arsenical treatment was instituted on May 15, 1936, with a 0.3-gram injection of neoarsphenamine, followed by 0.45 gram on May 19 and 0.4 gram on May 26. He received three injections of bismuth salicylate as concurrent treatment.

Two days after the last injection of neoarsphenamine the patient complained of headache, general malaise, and an itching rash over the chest and abdomen. He was given 0.5-gram of adrenalin hydrochloride subcutaneously, and 1 gram of sodium thiosulphate intravenously, at 8 a. m. and 4 p. m. The skin condition developed rapidly into a generalized severe urticarial rash. At 8 p. m., following an attempt to give 500 cubic centimeters of Fischers' solution by proctoclysis, he had an epileptiform type convulsion lasting about 5 minutes, after which he appeared stuporous, responding when his name was spoken but not replying to questions. About 15 minutes later an attempt to administer 50 percent glucose solution intravenously was threatened by recurrence of convulsion. He was given one-half grain of codeine sulphate, after which he became quiet. The third convulsion occurred about 11:45 p. m., when the patient was apparently disturbed by the closing of a door. He was given one-fourth grain of morphine sulphate, after which he became quiet and slept for several hours. On May 29 and 30 he was given 0.5 gram of adrenalin hydrochloride subcutaneously, followed in 4 hours by 1 gram of sodium thiosulphate intravenously. The rash began to fade the following day and he showed signs of rapid improvement. He was returned to duty in 11 days, under observation.

(28-1936.) The source of infection in this case is unknown. The patient was given a diagnosis of syphilis because of evidence of primary infection on the glans penis and repeated 4-plus Kahn blood tests. The patient stated that he had a small sore on the penis in September 1932.

From November 27, 1934, to February 12, 1935, he received 10 intramuscular injections of bismosol; from March 25 to June 26, 7 injections of neoarsphenamine, a total of 3.3 grams, and 7 intramuscular injections of tryparsamide, a total of 19.5 grams; from July 3 to 24, 3 intravenous injections of tryparsamide, a total of 9 grams; from August 9 to October 25, 20 injections of mercury succinimide; and on October 30, a 1.5-gram intravenous injection of tryparsamide. Ten and one-half hours after this injection the patient experienced a mild optic neuritis reaction. Recovery in 6 days. (Case 107-1935, UNITED STATES NAVAL MEDICAL BULLETIN, January 1936.)

During the month of November 1935 he received two injections of bismuth salicylate. The fourth course of arsenical treatment began April 1, 1936, with a 0.25-gram injection of neoarsphenamine, followed by 0.45-gram injections on April 8 and 15, and 0.8-gram injections on April 22, 29, and May 6. Five injections of bismuth salicylate were given as concurrent treatment.

On May 13, 1936, the patient reported for the seventh injection of neoarsphenamine and stated that 5 days after the last injection (May 6) he noticed a slight generalized skin rash which gradually became worse. Examination showed a profuse evenly distributed skin eruption, macular and maculopapular in character, confluent in many places, and more marked over the exposed surfaces. Physical examination otherwise negative. He was given a 0.8-gram injection of neoarsphenamine and 2 days later the skin condition developed into a severe generalized erythema, more marked on the face, scalp area, and feet. The eyelids are moderately swollen. Red blood count, 5,010,000; white blood count, 22,000; hemoglobin, 95 percent; band forms, 18; segmented, 25; lymphocytes, 16; eosinophiles, 16; and monocytes, 18. The skin condition gradually developed into a severe exfoliative dermatitis, followed by desquamation over the entire body. All hair was shed except the beard.

The patient ran a stormy course for 6 weeks, with temperature between 101° and 103° F. On one occasion he experienced delirium. The treatment was symptomatic and supportive. One gram of sodium thiosulphate was administered intravenously, May 20, 21, 22, 23, 24, 26, and 27. After the first 6 weeks, improvement was progressive and rapid. The hair returned and appeared normal; the skin became of almost normal texture aside from some slight scaling over the shins and scapula. The nails, however, had not returned. He was discharged to duty with the recommendation that he continue to apply some soothing ointment to the scaling areas of the skin. Recovery in 149 days.

(29-1936.) This patient was exposed to infection June 23, 1936, and 1 month after exposure developed several small ulcers on the glans penis which did not respond to local treatment. On August 3, 1936, a darkfield examination of the ulcers was positive for *Treponema pallidum*. Arsenical treatment was instituted August 6, with a 0.3-gram injection of neoarsphenamine, followed by 0.45-gram injections on August 13, 20, 27, September 3, 10, 17, and 24, 1936. Six intramuscular injections of bismosol was given as concurrent treatment. Eight days after the last injection of neoarsphenamine he complained of a skin rash which he stated was of about 4 days duration. He felt well and the rash had caused no discomfort. Examination showed an area over the left shoulder of cracked weeping dermatitis, with several small red spots on the back and feet. The eyes were slightly puffed and the face reddened. The rash gradually developed into a severe exfoliative dermatitis involving the face, neck, trunk, and anterior aspects of both thighs and legs with moderate edema of the face and well marked conjunctival injection. The skin condition showed steady improvement after 2 weeks and terminated in desquamation. Recovery in 36 days.

SULPHARSPHENAMINE

(30-1936.) The source of infection in this case is unknown. Arsenical treatment was instituted because of repeated 4-plus Kahn blood tests. From March 27 to October 10, 1935, he received 20 injections of neoarsphenamine, a total of 11.1 grams, and 18 intramuscular injections of thiobismol; from November 5 to December 17, 1935, 12 injections of mercury succinimide; and on December 19, a 0.3-gram injection of neoarsphenamine. After the last injection of neoarsphenamine the patient stated that he had experienced chills, and pains in the joints following each injection of neoarsphenamine. Loss of considerable weight was noted. Neoarsphenamine was discontinued and alternate courses of bismarsen and mercury succinimide were given intramuscularly. From December 31, 1935, to March 17, 1936, he received 20 intramuscular injections of bismarsen, a total of 3.5 grams, and from March 21 to May 29, 1936, 16 injections of mercury succinimide. The fourth course of arsenical treatment began May 28, 1936, with a 0.15-gram intramuscular injection of sulpharsphenamine, followed by a 0.25-gram injection on June 12, and 0.4-gram injections on June 16 and 26. Twenty-four hours after the last injection he developed a generalized papular rash accompanied by severe itching, followed by chills, fever, and general malaise. The patient registered no complaints after the first three intramuscular injections of sulpharsphenamine, but upon being questioned he stated that the skin itched for about 24 hours after the first two injections, and that a badly itching rash appeared over the shoulders after the third injection. One gram of sodium thiosulphate was given daily, for 4 days. The skin condition developed into a severe exfoliative dermatitis which terminated in desquamation. The

rash showed a steady improvement from beginning of treatment. Recovery in 41 days.

(31—1936.) This patient (supernumerary, native of Guam) was given a diagnosis of yaws because of enlarged epitrochlear glands, typical lip lesion, and a 4-plus Kahn blood test. He was given a 0.3-gram injection of sulpharsphenamine intramuscularly, October 18, 1936, and 6 hours later a macular rash appeared on the trunk and limbs. Examination revealed—difficulty in breathing and edema of the face, hands, arms, ankles, and scrotum. He was given 0.3 gram of sodium thiosulphate, followed by 15 minims of adrenalin. Improvement began immediately. The rash developed into a severe exfoliative dermatitis which terminated in desquamation. The rash showed a steady improvement from beginning of treatment. Recovery in 24 days.

NEOARSPHENAMINE

(32—1936.) This patient was given a diagnosis of syphilis on September 14, 1934, because of a 4-plus Kahn blood test and history of a penile lesion. Arsenical treatment began on August 25, 1936, with a 0.3-gram injection of neoarsphenamine, followed by a 0.45-gram injection on September 1, and 0.6-gram injections on September 8 and 15.

On September 22, 7 days after the last injection of neoarsphenamine, the patient developed a slight reddish papular eruption on the arms, but had no general symptoms or other complaints. He was given a 0.13-gram intramuscular injection of bismuth subsalicylate.

September 24: The rash has spread to the trunk and face. The areas originally affected are more erythematous and confluent. There is intense pruritus and edema of the skin, especially about the face. One gram of sodium thiosulphate given intravenously.

September 25: The entire body surface is involved by an erythematous, moderately indurated dermatitis, and the face shows numerous vesicles. One gram of sodium thiosulphate given intravenously.

September 26: The vesicular eruption has appeared on nearly all skin surfaces. Temperature ranges from 101.8° to 103° F. The patient complains of slight nausea and weakness. One gram of sodium thiosulphate given intravenously.

September 27: The vesicles on the face, thorax, and arms have ruptured, leaving thickened yellow scales of coagulated serum. Slept poorly during the night.

September 28: The patient's condition remains essentially unchanged, with marked swelling and crusting of the skin about the face. He is nauseated but vomits little. One gram of sodium thiosulphate given intravenously.

September 30: The patient feels better but little definite change is noted since the onset of the vesicular manifestations. Nausea has abated to some extent and he is able to take fluids more freely with consequent increase in urinary secretion. Temperature is 102° F.

October 1: The patient shows improvement. No nausea. Intake, 3,220 cubic centimeters and output, 335 cubic centimeters.

October 3: The patient shows considerable improvement. Scaling is profuse. Alkaline tub bath to remove some scabs. Intake, 3,485 cubic centimeters, and output, 1,870 cubic centimeters. Urinalysis normal.

October 5: Improvement continues. Profuse scaling of the body. Temperature normal.

October 7: Practically all scabs have disappeared and severe erythema of the body is noted. Edema of the genitals, legs, and feet. Intake, 6,800 cubic centimeters, and output, 3,675 cubic centimeters. Temperature 99.2° F. to 99.8° F.

October 9: The skin condition is much improved. Pruritus is intense and edema of the genitals and extremities still present.

October 14: Improvement continues. He has considerable difficulty in sleeping at night, but codein, one-half grain, produces some relief.

October 19: The crust on the skin surfaces has completely disappeared and the skin is now soft, quite red, and somewhat tender. Moderately intense pruritus. Temperature normal for entire day for the first time.

October 24: The skin is quite clear, but pruritus continues. He was given three-eighths of a grain of ephedrine which produced some relief from this condition at night. Definite edema of both feet and ankles which appears to be secondary to lymphatic stasis rather than due to renal pathology. Urinalysis normal.

October 29: The patient is allowed in a wheel chair. Persistent pruritus and swelling of the ankles.

November 6: He is allowed to walk about the room and placed on regular diet. The patient has been afebrile since October 19.

November 11: A moderately generalized dermatitis, resembling dermatitis herpetiformis, has appeared. Calcium lactate, 15 grains, cod-liver oil, and calamine lotion applied to affected areas.

The patient continues to improve. He is symptom-free except for a persistent pruritus and repeated attacks of a papular rash over the face, chest, and extremities. Tests of urinary function indicate no permanent kidney damage. Transferred to the United States for further treatment.

Between the dates of January 1 and February 5, 1937, the patient was enroute to the United States and showed no change in his condition. Examination on February 5 showed slight scaling and eruption of flexor surfaces of the arms and knees. The patient had no complaint.

February 9: He was given 0.065 gram of bismuth salicylate. Itching more marked and eruption more red and distinct.

An itching papular eruption was noted on the right forearm, in the axillary space, and slightly on the calves of the legs on February 15. One gram of sodium thiosulphate was given on this date followed by 1 gram February 17 and 24. The dermatitis disappeared only to return on the elbows the following day. One gram of sodium thiosulphate was given on March 8 and 10; 0.065 gram of bismuth salicylate on March 11; 1 gram of sodium thiosulphate on March 12 and 15; 0.065 gram of bismuth salicylate on March 16; and 1 gram of sodium thiosulphate on March 17. On March 22 the skin lesions had healed. He was given 0.065 gram of bismuth salicylate on March 23; 0.01 gram of mapharsen on March 25; 0.02 gram of mapharsen on April 1; 0.065 gram of bismuth salicylate on April 6; 0.03 gram of mapharsen on April 8; 0.065 gram of bismuth salicylate on April 13, 20, 27, and May 4; 0.03 gram of mapharsen on April 15; 0.04 gram of mapharsen on April 22 and 29; and 0.05 gram of mapharsen on May 6.

On May 19 an area of dermatitis appeared on the left ear and under the right arm, with slight scaling and very little itching. A 10 percent solution of sodium thiosulphate was applied daily and the rash subsided within 7 days.

Blood pictures

Date	Erythro- cytes	Leuko- cytes	Hemo- globin	Juve- niles	Band forms	Seg- mented	Lym- pho- cytes	Eosino- philes	Baso- philes	Mono- cytes
Sept. 24, 1936.....	5,220,000	6,500	80-90	2	5	28	43	15	2	3
Sept. 25, 1936.....	4,200,000	5,200	100	-----	18	40	30	8	-----	4
Sept. 26, 1936.....	4,660,000	5,500	90	3	39	19	17	10	-----	12
Sept. 27, 1936.....	5,290,000	11,000	90-100	3	41	31	18	2	-----	5
Sept. 28, 1936.....	3,650,000	8,150	90	1	28	26	21	19	-----	5
Sept. 29, 1936.....	4,110,000	6,000	80-90	3	33	10	23	19	-----	12
Oct. 3, 1936.....	4,300,000	11,800	80-90	-----	8	11	32	39	-----	10
Oct. 5, 1936.....	4,340,000	16,200	80-90	2	15	30	13	33	-----	7
Oct. 7, 1936.....	4,450,000	12,000	90	1	7	33	20	35	-----	4
Oct. 14, 1936.....	4,320,000	7,850	-----	-----	9	39	34	8	-----	10
Oct. 19, 1936.....	3,980,000	7,700	70	-----	4	39	35	16	3	3
Oct. 24, 1936.....	4,300,000	8,600	80-90	-----	10	40	32	15	-----	3
Oct. 29, 1936.....	4,000,000	7,000	80	-----	2	39	36	16	-----	7
Nov. 6, 1936.....	4,340,000	7,600	80	-----	7	37	37	4	1	14

According to report received in the Bureau dated June 2 the patient is still on the sick list.

FATAL REACTIONS

(33-1936.) A patient (supernumerary, native of Guam) had a history of yaws since childhood. Repeated Kahn blood tests were 4-plus. Arsenical treatment began on January 15, 1936, with a 0.25-gram injection of neoarsphenamine, followed by a 0.4-gram injection on January 22, and 0.5-gram injections on February 6, 13, and 20. Three days after the last injection the patient developed a generalized severe exfoliative dermatitis, followed by edema of the body and face. The eyes were closed due to swelling. Temperature 98.8° F., pulse 86, and respirations 26.

March 1: Red blood count, 3,300,000; white blood count, 10,600; hemoglobin, 70 percent; segmented, 40; band forms, 18; lymphocytes, 22; eosinophiles, 16; juveniles, 4. Urine shows slight trace of albumin.

March 12: Urine shows 3-plus albumin, hyaline and fine granular casts, many red and white blood cells, and numerous epithelial cells. The patient received 1 gram of sodium thiosulphate intravenously and 2 grams by mouth on March 1, 2, and 3, and 1 gram intravenously on March 4. His condition gradually became worse and he died at 9:15 a. m. on March 15, 1936, 24 days after onset of the first symptoms.

(34-1936.) A patient (supernumerary female, native of Guam) was given a diagnosis of syphilis because of clinical and serological findings. Arsenical treatment began with a 0.25-gram injection of neoarsphenamine on December 8, 1935. Two hours after the injection the patient developed a mild vasomotor phenomena reaction, which will be described in a later bulletin. She recovered within 24 hours. Arsenical treatment was continued and she received 0.5-gram injections of neoarsphenamine on January 8, 15, and 22, 1936. Two intramuscular injections of bismosol were given as concurrent treatment. Four hours after the last injection of neoarsphenamine she complained of moderate chills. Temperature 102° F., and pulse 120.

January 24: The patient's temperature, pulse, and respirations are normal and there are no subjective symptoms. She is up and about the ward.

January 27: She complains of itching over the face and arms. The skin shows roughening but not strikingly abnormal in the Chamorran race.

January 28: A well-developed measles-like itching rash is noted over the entire body and face. Temperature 99° F., pulse 92, and respirations 22.

February 1: Dusky red rash, marked edema of the face and arms, eyes are nearly closed, a slight chill. Temperature 102° F., pulse 110, and respirations 30.

February 3: Large pustular blebs scattered over the body. Serous oozing from the face, chest, and back, with crusting. Temperature 105° F., pulse 130, and respirations 20.

February 4: Edema progressing, the eyes are closed, the skin over the arms and trunk is swollen and tense, with sero-purulent crusting confluent on the face and arms. Temperature 104° F., pulse 110, and respirations 30.

February 6: Pains in the arms and back, skin infection is spreading, marked exfoliation is noted on the abdomen and neck. Temperature 104.2° F., pulse 108, and respirations 26.

February 8: Sore throat, fissures about the mouth and the pharynx show deep infections but no ulcerations. Chills follow immediately when skin is exposed to air, generalized exfoliation to umbilicus. Temperature 103.6° F., pulse 110, and respirations 24.

February 9: The face, arms, neck, and back are brawny and edematous, covered with sero-purulent crusting and exfoliated areas. Temperature 103° F., pulse 110, and respirations 26.

February 10: Swelling of the face has subsided somewhat. The patient complains of cramp-like pains in the abdomen. Examination shows no distention or localized tenderness. General condition slightly improved. Vomiting occurred late in the afternoon, followed by involuntary bowel movement and loss of bladder control.

February 11: Early this morning her pulse became very poor, followed by unconsciousness and death at 8:05 a. m., twenty days after the onset of the first symptoms.

Blood picture

Date	Red blood count	White blood count	Hemoglobin	Band forms	Segmented	Lymphocytes	Basophiles	Mono-cytes	Eosino-phil	Myelo-cytes	Ju-ve-niles
Jan. 20, 1936.....	4, 100, 000	8, 200	80	3	62	20	-----	1	13	-----	1
Feb. 3, 1936.....	-----	10, 000	-----	10	44	12	1	3	25	1	3
Feb. 4, 1936.....	-----	10, 900	-----	8	43	16	5	-----	28	-----	-----
Feb. 5, 1936.....	-----	17, 900	-----	18	30	15	-----	2	31	1	3
Feb. 7, 1936.....	3, 160, 000	16, 000	70	15	31	13	-----	6	29	-----	6
Feb. 8, 1936.....	-----	17, 400	-----	17	30	20	-----	-----	27	2	4
Feb. 10, 1936.....	-----	17, 100	-----	18	29	19	-----	-----	30	1	3

SUMMARY

In 1936 medical officers of the Navy administered 106,041 doses of arsenicals and reported the occurrence of 76 reactions therefrom. Of these reactions almost one-half (34) were arsenical dermatitis; a ratio of 1 case of dermatitis to 3,119 doses. Of interest in connection with the etiology of arsenical dermatitis is the number of instances in which premonitory signs were noted. These signs are repeated below and serve to indicate the necessity for careful examination and questioning of each patient before administering an arsenical.

Case 3.—After receiving 41 injections of neoarsphenamine, a circumscribed itching oozing plaque developed on the right forearm. A mild erythematous rash appeared after the forty-third injection.

Cases 8 and 9.—A mild erythematous rash developed after the second injection of neoarsphenamine. The third injection, given 11 days later, caused recurrence of the rash.

Case 12.—Urticaria followed the second injection of neoarsphenamine. A test dose given 6 days later caused recurrence of urticaria.

Case 13.—Unreported skin rash of 2 weeks' duration developed into a macular dermatitis.

Case 16.—A mild blood dyscrasia followed the fourteenth injection of neoarsphenamine. A severe arsenical dermatitis (fixed exanthem) followed the first injection of a course of neoarsphenamine given 18 months later.

Case 18.—A mild vasomotor phenomena reaction followed the sixth injection of neoarsphenamine. Severe exfoliative dermatitis followed the eighth injection given 16 days later.

Case 19.—Unreported mild itching rash appeared after the seventh injection. After the eighth injection the rash become more severe. Exfoliative dermatitis followed the ninth injection.

Case 21.—Unreported mild itching eruption appeared the day following the eleventh injection. Nine days later the patient reported a generalized exfoliative dermatitis.

Case 22.—Two red spots on the right leg followed the second injection. A severe arsenical dermatitis (fixed exanthem) followed the eighteenth injection.

Case 23.—Unreported red and indurated skin appeared 24 hours after the ninth injection. Three weeks later the twelfth injection was followed by exfoliative dermatitis.

Case 25.—Slight transitory edema of the lips occurred 1 hour after the fourth injection of neoarsphenamine. Exfoliative dermatitis developed after the sixth injection given 2 weeks later.

Case 26.—Unreported rash on the arms and legs followed the eighth injection. Three days later received treatment for poison ivy rash. Eight days later severe exfoliative dermatitis developed.

Case 28.—Optic neuritis reaction followed the eighteenth injection of an arsenical. Profuse evenly distributed skin eruption appeared after the twenty-fourth injection. The twenty-fifth injection, given 7 days later, was followed by severe exfoliative dermatitis.

WATER SUPPLY—NAVAL STATION, GUAM¹

The water supply has been adequate in quantity. The reservoirs have been well filled. The warning to boil all drinking water was repeated daily.

¹ Abstracted from monthly sanitary reports for January and February 1937.

The following is the report of the water analyzed during the months:

Date	Place	Dominick-Lauter test	Bacterial count
			<i>Colonies per cc</i>
Jan. 9, 1937	Torre's well	Positive	2,500
Jan. 9, 1937	Agana Spring	do.	500
Jan. 9, 1937	Fonte Reservoir	do.	400
Jan. 9, 1937	Fonte system	do.	350
Jan. 9, 1937	Asan (laboratory spigot)	do.	60
Jan. 16, 1937	Fonte Reservoir	do.	300
Jan. 16, 1937	Agana Spring	do.	1,300
Jan. 16, 1937	Fonte system	do.	210
Jan. 16, 1937	Torre's well	do.	1,800
Jan. 22, 1937	do.	do.	2,600
Jan. 22, 1937	Agana Spring	do.	780
Jan. 22, 1937	Fonte Reservoir	do.	510
Jan. 22, 1937	Fonte system	do.	280
Jan. 22, 1937	Asan (laboratory spigot)	Negative	60
Jan. 30, 1937	Torre's well	do.	8,400
Jan. 30, 1937	Agana Spring	Positive	430
Jan. 30, 1937	Fonte Reservoir	do.	400
Jan. 30, 1937	Fonte system	do.	110
Jan. 30, 1937	Asan (laboratory spigot)	do.	75
Feb. 4, 1937	Torre's well	Negative	8,400
Feb. 4, 1937	Agana Spring	Positive	430
Feb. 4, 1937	Fonte Reservoir	do.	400
Feb. 4, 1937	Fonte system	do.	110
Feb. 4, 1937	Asan (laboratory spigot)	do.	75
Feb. 5, 1937	Sumay galley	do.	40
Feb. 5, 1937	Pan-American Airways	Negative	110
Feb. 5, 1937	Yigo Reservoir	Positive	180
Feb. 5, 1937	Agat	Negative	70
Feb. 5, 1937	Yigo rain water	Positive	870
Feb. 5, 1937	Sumay, sickbay	Negative	26
Feb. 8, 1937	Inarajan	Positive	1,200
Feb. 8, 1937	Merizo	do.	600
Feb. 8, 1937	Umatac	do.	2,200
Feb. 8, 1937	Maina Springs	Negative	180
Feb. 12, 1937	Agat	do.	70
Feb. 12, 1937	Pan-American Airways	do.	30
Feb. 12, 1937	Atantanotupu ¹	Positive	4,100
Feb. 13, 1937	Sumay, galley	Negative	240
Feb. 13, 1937	Sumay, sickbay	do.	160
Feb. 17, 1937	Swimming beach	Positive (4)	120
Feb. 17, 1937	Tumon School well ²	do.	2,100
Feb. 21, 1937	Asan (laboratory spigot)	Negative	60
Feb. 26, 1937	Bulter's filtered water	do.	220
Feb. 26, 1937	Tumon School well ³	Positive 100 plus	5,600
Feb. 28, 1937	Asan (laboratory spigot)	Positive (25)	400
Feb. 28, 1937	Agana Spring	Positive (4)	210

¹ Water from Atantanotupu shows a salinity of 100.7 parts per million. (5.76 grains per United States gallon) expressed as NaCl.

² Water from Tumon School well shows 162 parts of NaCl per million. (8.98 grains per United States gallon).

³ Water from Tumon School well shows a salinity of 87.75 parts per million. (5.13 grains per United States gallon) expressed as NaCl.

NOTE.—Numbers in the report of Dominick-Lauter results refer to the approximate number of organisms of the *Coli-Aerogenes* group of fecal origin, per 100 cubic centimeters, of sample water.

In view of the intermittent findings of evidence of fecal contamination of all water supplies, the importance of early installation of chlorination facilities was urged. In eight of the schools of Agana chlorinated water was furnished for drinking purposes.

Inspections.—The Agat water-supply reservoir was inspected on January 11 in company with the public-works officer. This reservoir of 105,000 gallons rated capacity is situated on the western slope of Mount Alifan about 2 miles east of the town of Agat and 285 feet

above sea level. The water issues from numerous apertures in the coral limestone rock, and this is entirely surrounded by the walls of the reenforced concrete reservoir. These walls effectively prevent all surface contamination from the bluff at the rear, as contrasted with the situation at Asan Reservoir. A superficial study of the geology of Mount Alifan would seem to indicate that it is formed by an igneous intrusion beneath the coraliferous limestone of the ancient reef or island, the molten, rock-forming material, beneath the coral, raising it up in the form of a cap, and metamorphosing the contiguous mass into a real limestone, and cascajo. In many places the limestone cap is missing, or has disappeared, leaving the so-called savannah slopes and table lands. In other places the coral cap is very thin, perhaps due to solution or erosion. Where this occurs on a sufficiently high slope springs of water are often found. It would seem that the meteoric waters falling on the porous limestone descend directly through it until they reach the impervious, igneous, or volcanic stratum, and then flow down the slope through or beneath the limestone, ultimately to the sea.

If the limestone cap is deficient anywhere, then the ground water has opportunity to issue forth as a spring. Some of these springs flow directly into the sea, and may be seen from many of the beaches. Others occurring on slopes of hills or mountains have been utilized as water supplies, of which Asan and Agat are examples. The latter is the sole supply of Sumay, with the marine barracks, the Pan-American Airways, and the town of like name. It is doubtful if springs in limestone rock can ever be considered safe from surface contamination as the water makes for itself and flows in quite sizeable channels, and does not have the natural filtering action of more compact soils or sand.

The mountain behind the Agat Reservoir extends some 250 feet higher, much of it planted with coconut trees for copra production. It is inconceivable to think that workmen gathering this product in such wild country should inconvenience themselves greatly in disposing of urine or feces. It is believed that such contamination could find ready passage downward through the cascajo or limestone with rain water and enter the ground water beneath it which feeds the spring. This would satisfactorily account for the continuously Dominick-Lauter findings from this supply during the rainy season. In the opinion of the health officer this drainage area behind the reservoir should be closed to man and animals.

On the same day, the party hiked over the divide north of Mount Alifan and went south along the eastern slope of the north and south mountain for a distance of 3 or 4 miles, as far as the flank of Mount Almagosa. Several of the upper tributaries of the Talofoto River,

the largest on the island, were crossed. On the side of Mount Almagosa a typical limestone cavern large enough for men to stand erect, was entered and followed into the side of the mountain for perhaps 200 feet. It divided and subdivided into a multitude of lateral tributaries and was evidently excavated by flowing water. The barometric altitude was about 720 feet above sea level. A large stream of water issued from a similar smaller cavern nearby, forming the head of a stream.

Somewhat lower down, perhaps at about 700 feet elevation, a spring, Almagosa Springs, was seen, and the combined effluent of the flow of the cavern and spring (Gagot River) was probably in the neighborhood of 2 million gallons per day. For perhaps a quarter of a mile the Gagot runs underground beneath the limestone. Shortly after the emergence it is joined by a large tributary (the Dobo), said to issue from Dobo Springs, not far distant. The combined flow of the enlarged river (also called Gagot), just below the junction, at a barometric elevation of 677 feet, was estimated as 5,184,000 gallons per day. Inasmuch as the elevation of the reservoir and pipe-line head at Agat is 285 feet, it would seem to be a feasible matter to run water by gravity from Almagosa Springs to Agat and Sumay, and as much farther as desired. The water would seem to be potable in its natural condition, as its source is the impenetrable jungle of the mountain top. During the dry season the supply at the Sumay area is insufficient, and this shortage has been intensified by the Pan-American Airways establishment with its large demands.

Approximately 3 miles to the north and east of Almagosa Springs a water fall was encountered. This falls is located upon another stream (the Maula), rising in the calcareous forest. This fall (Maula Mapalaspas), which would be notably beautiful in any country, has a sheer drop of 50 feet into a large pool of clear, cool, sparkling water. The sheet of falling water is about 20 feet broad, and the scene is framed by the dense jungle growth of either side of the canyon and above. The barometric elevation of the pool is 200 feet above sea level. The stream flow over the falls is estimated to be 2,000,000 gallons per day. Of course this is too low to hook up by gravity with a potential water line to Agat, but the 50 foot fall does suggest the possibility of power development.

It should be kept in mind that the above discussed tributaries of the Talofoto River are an entirely different group from those mentioned in a previous report as feeders of a potential reservoir at Bonya. There is yet another group of tributaries of the Talofoto which have their origin farther south from the slopes of Mount Jumullong Munglo and the volcanic ridge east of Umatac.

The population of Guam has doubled during the American occupation. If the same rate continues during the next 40 years, some

place must be found to locate the increase unless the natural forces of pestilence and famine are allowed to impose a natural limit. At present, population trends to stay huddled along the shore, by reason of lack of communication and transportation to the interior. During the rainy season the back of the carabao is virtually the sole means. It is the belief of the health officer that the largest valley, the Talofoto, is potentially rich agriculturally, has the most reliable water supply throughout the year, and is capable of maintaining many thousands of people.

The picture of to-day is that after 39 years of American occupation, with an average of 90 inches of rain falling on the island annually, much of it on mountainous slopes, it, as yet, performs no useful work. Ships asking for 100 tons of water (24,000 gallons) are given half the required supply. The Asan Reservoir with a maximum capacity of only 83,000 gallons, frequently has but a few inches or feet of water in the bottom, much less than the needed amount. The more given to ships the more is the interruption of the domestic supply and pressure. There is either a superabundance or a lack. There is no storage of potable water for Agana, the largest reservoir holding but half a day's supply. During the dry season it is usually necessary to ration the water supply for domestic use and for ships. Additional connections with and load upon the Asan supply, except in the case of Americans, has been disapproved as a policy because of the resulting intensification of the regular seasonal shortage.

The need for a dependable all the year around potable water supply would seem to be imperative. While the development of the Talofoto Valley is not primarily a matter strictly military, nevertheless naval officers sent here for duty, who are the sole administrators, must come face to face with the problem of water supply and population, and must either point the way to solution, or evade the issue. The provision of adequate water for ships and naval station and marine barracks is a military matter, even without considering the minimum necessities of Pan-American Airways.

Instructions regarding the use of chlorine for the purification of water for drinking purposes, as an alternative to boiling, have been published. While boiling of water is a safer method, in that it does destroy the cysts of amoeba histolytica, nevertheless, it is believed that the great expense, time, and labor involved in the boiling of water with inadequate facilities prevents its wide use in the house and elsewhere. People prefer to take a chance rather than go to the trouble of boiling the water.

A new reservoir has been constructed at Maina Springs to connect with the Asan system. The pipe-line has not yet been com-

pleted. The water shed is believed to be safe against ordinary human contamination. Some of the samples examined have been shown to be free of contamination. The springs flow from the side of a low mountain for the most part thickly covered with jungle growth. It is about a mile from the center of Agana, south of the Piti road. The geology and the method of construction of the reservoir would seem to be very similar to that of Asan Springs.

It may be pertinent to note here that the routine water examinations since the month of October have seemed to show consistently higher bacterial counts than formerly. A year ago we had every reason to believe that our Asan and Agat supplies were safely potable. Even Agana Springs regularly showed low counts and negative tests. Now, it would seem that all our sources show frequent evidence of contamination.

All of the spring water comes from limestone rock and from the geologist's point of view it cannot be relied upon. It is natural to speculate on the cause of such a change. It would be difficult to disprove that the earthquake in October 1936, of number 8 severity, together with the several hundred shocks of minor severity which followed, may not have opened up new and direct water channels from the earth's surface to those older channels which have in the past been the feeders of the ground waters and our springs. and in so doing destroyed the natural biological filtration of the soil and permitted entrance of contamination.

A new shallow well has been drilled at Tumon School. Only sand and limestone were penetrated for approximately 35 feet. The flow at present is not large. The water, while having a rather high chloride content, is considered safe after chlorination.

Water prospecting.—The Inarajan water shed was inspected on February 14. This river has its origin in the volcanic uplands of the southern extremity east of Mount Sasalaguan and is believed to be one of the largest on the island. It flows upon impervious strata and between rolling hills, protected for the most part by jungle and other vegetation against evaporation. In steadiness of volume it can be relied upon throughout the year in greater degree than most any other in Guam. It is exposed to contamination on the open range, where both wild and domestic carabao use it at will. About a mile above the mouth, the river is partially harnessed by a low dam and irrigating system for use by the dependent rice fields. The Inarajan Dam, affording intake for the pipe-line to the town, is located about 2 miles above the mouth on the top of an impressive water fall 50 or more feet high. Although the dry season had begun and the ground was cracked and parched for lack of moisture, water was

flowing over the spillway of the dam at an estimated rate of 807,000 gallons per day.

The second of the falls noted will be called here, Laolao Falls, the estimated height of which is 50 feet. The amount of water passing over this falls was computed as at the rate of 728,000 gallons per day. The water from this enters the Inarajan River above the Inarajan Dam and Falls.

Another fall, which may be called the Sinagosa Falls, was encountered west of the Inarajan Dam on another tributary of the Inarajan River. The top of the fall gave a barometric elevation of 230 feet above the sea level. The height of the fall, although not a sheer drop, is estimated to be 85 feet, and the stream flow as 864,000 gallons daily.

It is a matter of some surprise that none of these falls are indicated on any of the most detailed contour maps of Guam or seem to be commonly known to Americans. These waters seem to be grossly potable, and, at the times of observation, have shown no silt or other sediment. They could be easily chlorinated without the expense of sedimentation or coagulation. It is believed there is enough power available to supply local needs.

It is worthy of note that in this upland region there are sites which would readily lend themselves to water storage at small cost. The elevation above sea level is adequate for pressure, and the soil, being clay or massive rock, seems impervious. Excavations ready-formed by water and wind erosion are available for reservoirs.

One of the greater needs of Guam is water storage sufficient to carry through the 4 months' dry season. There might well be storage facilities constructed to meet the need, prevent damage to lands below, and supply water and power throughout the year. The Talofofo in the central valley of the island is the largest river and has the largest volume of water available for storage in both wet and dry season. The area so far encountered, which most readily lends itself to large scale storage is the natural basin located on the Bonya or Talisay branch of the Talofofo. A flow of $4\frac{1}{2}$ million gallons daily was roughly estimated in September 1936, with evidence for a flow of 50 or 100 million gallons daily in time of flood. The basin has a narrow outlet and dam construction would seem easy.

FOOD POISONING ON BOARD THE U. S. S. "MARYLAND"

The outbreak occurred February 15, 1937, and involved 34 men. All but two of the cases recovered promptly and were restored to duty the following day. Information for these two cases is as follows:

4527—37—12

Onset.—Sudden.

Symptoms.—Nausea; vomiting, about five to six times in three hours; abdominal cramps; diarrhea, six to eight fluid bowel movements, feces containing blood and mucus; spasmodic pain; colic; sudden marked prostration.

Physical examination.—Patients appeared ill, face pale, skin cold and damp, slightly cyanotic. Pulse 88, very weak, temperature subnormal, respirations 20, breathing regular, blood pressure 70/50 on admission, 90/70 in 2 hours, white blood count normal, urine negative, cultures made from feces specimens show a pure growth of *E. coli*, cultures made from specimen of vomitus negative for typhoid and dysenteriae type of organism, cultures made from the ham specimens negative for the coli and aerogenes group of organisms.

Suspected food.—Ham; a shipment, totaling 2,202 pounds, was purchased under contract and received on board February 13, 1937, where they were placed in cold storage at 20° F. About 700 pounds were broken out of cold storage at 0600 February 14, and after being thawed out were boiled for about 3 hours on the same date. At the end of that time the hams were transferred to another kettle, drained, and allowed to cool with the lid closed. The hams remained in the galley until 0900, February 15, when they were cut up and served at the noon meal. A portion of this same shipment of 700 pounds was cooked and served aboard this ship for the noon meal February 22, 1937, and no ill effects were reported.

In addition to the general mess, all special messes (wardroom, junior officers', warrant officers', and chief petty officers') served ham from the same shipment from which the suspected ham came. No individual who ate ham in any of these special messes suffered from any symptoms of food poisoning. No ham was available for examination.

After a careful study of circumstances surrounding these cases of food poisoning and the laboratory report on specimens submitted for examination, it is the opinion of the medical officers that the causative agent was a bacterial toxin (definite identification not being made). It is believed that this toxin was from a surface contamination which readily grew in the closed kettles in a warm temperature after the hams had been boiled. It would seem advisable that hams should be immediately placed in the chill room after boiling or they should be thoroughly reheated before serving if a recurrence of food poisoning is to be avoided.

VENEREAL DISEASES—U. S. PENNSYLVANIA

[Abstracted from the annual sanitary report for the calendar year 1936 submitted by S. S. Cook, Commander, Medical Corps, U. S. Navy]

Year	Admissions				Rates per 1,000			
	Syphilis	Gonococcus infection, urethra	Chan-croid	All vene-real diseases	Syphilis	Gonococcus infection, urethra	Chan-croid	All vene-real diseases
1932.....	41	106	3	150	28.51	73.71	2.08	104.3
1933.....	34	90	19	143	23.41	61.98	13.09	98.5
1934.....	36	92	15	143	28.48	72.78	11.87	113.1
1935.....	20	105	17	142	15.54	81.59	13.21	110.3
1936.....	11	47	3	61	8.42	35.96	2.29	46.7

There was a remarkable reduction in admissions for venereal diseases in 1936 as compared with the preceding 4 years. In 1935 there were 142 admissions while in 1936 there were only 61. The most striking decrease occurred in admissions for chancroid, namely, 17 in 1935 and 3 in 1936. This may be due partly to the current practice of longer observation of all genital lesions. Daily dark-field examinations are made for a period of 7 days, and six blood-serum Kahn tests are performed at weekly intervals. The treatment of syphilis on this ship has been given considerable study and the following policy outlined:

1. Continuous treatment with neoarsphenamine and bismuth for all early cases.
2. Kahn tests monthly on all cases under active treatment. Quarterly for 3 years after completion of treatment. Annually for all those with histories of syphilis.
3. Spinal fluid examinations of all cases upon completion of treatment. On all Kahn fast cases. On allluetics with neurological manifestations.

At the annual syphilitic census held on December 31, 1936, there were 127 men on board with a history of syphilis and of these 53 had received treatment during the year. A special census was held on November 17, 1936, for the purpose of ascertaining the number of men on board with a history of venereal infection, and the following data obtained:

- (a) Number of enlisted men (Navy and Marines) on board: 1,336.
- (b) Number with history of syphilis: 130, 9.7 percent.
- (c) Number with history of venereal diseases: 384; 28.7 percent.

Prophylactic packages are given out in the sick bay to all who apply. Condoms are sold in the ship's service store. Each man who reports on board for duty is given a printed sheet containing information about venereal diseases. During the year 2,081 prophylactic treatments were given either on board ship or in an official station ashore. Of the 61 cases admitted in 1936, 29 took official prophylaxis, 32 did not. The time interval between exposure and prophylaxis was recorded in 1,567 instances:

Interval	Number of prophylaxes	Number of cases	Ratio	Interval	Number of prophylaxes	Number of cases	Ratio
0-1 hour.....	267	2	1-134	4-5 hours.....	151	1	1-151
1-2 hours.....	333	5	1-78	5-6 hours.....	91	0	-----
2-3 hours.....	336	9	1-37	Over 6 hours.....	132	2	1-66
3-4 hours.....	202	2	1-101				

Included in the above are 246 prophylaxes at shore stations. Of these 192 were within an hour after exposure. The only case which occurred after shore prophylaxis was a man who had three exposures in 1 day and several hours elapsed before prophylaxis. The 61 cases for the year according to disease and prophylaxis are as follows:

Disease	Prophy-laxis	No prophylaxis	Total
Syphilis.....	4	8	12
Gonorrhea.....	23	23	46
Chancroid.....	2	1	3
Total.....	29	32	61

It is not infrequently impossible to determine the place of origin of a case and the figures which follow are probably not accurate. However, it is believed they give a fair idea of what occurred and are therefore included as a matter of record.

Port	Number of cases	Days in port	Ratio	Port	Number of cases	Days in port	Ratio
San Pedro.....	27	165	1-6	Panama.....	6	11	1-2
Bremerton.....	15	80	1-5	San Francisco.....	4	14	1-3
Honolulu.....	4	29	1-7	Undetermined (leave).....	5		

The 29 cases that followed prophylaxis occurred in the following ports:

Port	Number of cases	Number of prophylaxes	Ratio
San Pedro area.....	18	734	1-40
Bremerton (Seattle area).....	4	514	1-128
Panama.....	4	518	1-129
San Francisco.....	0	130	
Honolulu.....	3	185	1-62
Total.....	29	2,061	

Subject to the remarks already made regarding the difficulty of determining with accuracy the port of origin, the figures which follow set forth the recorded source of the individual diseases:

Port	Syphilis	Gonorrhea	Chancroid	Total
San Pedro.....	6	18	3	27
Bremerton.....	3	12	0	15
Honolulu.....	1	3	0	4
Panama.....	1	5	0	6
San Francisco.....	0	4	0	4
On leave.....	1	4	0	5
Total.....	12	46	3	61

Until such time as the civilian authorities perfect organizations for epidemiological work in this field, reporting of cases to them will serve a useful purpose in bringing to their attention existing conditions, but can not serve the far more desirable end of reducing sources of infection.

**COMMON INFECTIOUS DISEASES OF THE RESPIRATORY TYPE, FIRST
QUARTER, 1937**

Monthly reports of communicable diseases received in the Bureau recorded a total of 8,068 cases of common infections of the respiratory type for the entire Navy for the first quarter of 1937, as compared with 3,063 admissions for the preceding quarter and 6,650 admissions for the first quarter of 1936.

There were 3,713 admissions for these diseases reported by shore stations in the United States and 139 from outlying naval stations and activities. The largest numbers of cases were reported from the following stations:

Station	January	February	March	Total
Naval training station, Norfolk, Va.	407	224	115	749
Naval training station, San Diego, Calif.	125	159	130	414
Naval training station, Newport, R. I.	192	98	101	391
Naval Academy, Annapolis, Md.	219	71	31	321
Naval air station, Pensacola, Fla.	51	55	76	182
Naval Academy, Annapolis, Md. (other than midshipmen)	105	44	21	170
Marine Corps base, San Diego, Calif.	117	16	18	151
Naval training station, Great Lakes, Ill.	97	15	25	137
Submarine base, New London, Conn.	74	15	44	133
Naval air station, Norfolk, Va.	67	18	15	100
Marine barracks, Quantico, Va.	29	35	34	98
Fourth Marines, Shanghai, China.	26	28	39	93
Marine barracks, Washington, D. C.	40	28	6	74
Navy Yard, Washington, D. C.	23	28	8	59
Naval air station, San Diego, Calif.	31	14	8	53
Norfolk Navy Yard, Portsmouth, Va.	12	35	4	51
Puget Sound Navy Yard, Bremerton, Wash.	33	6	7	46
Receiving ship, San Diego, Calif.	39	4	3	46
Naval air station, Anacostia, D. C.	24	16	2	42
Navy Yard, Philadelphia, Pa.	33	6	1	40
Marine detachment, Peiping, China.	17	8	12	37

Influenza was the cause of two deaths, complicated in one instance by lobar pneumonia (U. S. naval hospital, Newport, R. I.), and in the other by acute encephalitis (Marine barracks, Quantico, Va.).

In reporting the occurrence of respiratory diseases at various stations, the senior medical officers commented as follows:

Receiving ship, San Francisco, Calif. (Sanitary report for January 1937).—"Flu" prevalent on station and in bay region. Cases entered and carried as catarrhal fever, acute. Most of our cases seem to originate ashore and tend to recurrence. Some clinicians call it "chronic flu."

Marine Corps base, San Diego, Calif. (Special report dated Jan. 9, 1937).—The following report relative to a moderate epidemic of catarrhal fever, acute, is submitted:

Admissions		Admissions	
Jan. 1, 1937	3	Jan. 5, 1937	10
Jan. 2, 1937	4	Jan. 6, 1937	8
Jan. 3, 1937	2	Jan. 7, 1937	14
Jan. 4, 1937	6	Jan. 8, 1937	14

The most probable contributing factors are inclement weather and overcrowding of barrack spaces, occasioned by influx of troops.

Naval Air Station, Anacostia, D. C. (Sanitary report for January 1937).—A mild epidemic of catarrhal fever, acute, occurred on this station during the month, necessitating the admission to the sick list of 23 men for this condition. This epidemic is attributed to the inclement weather conditions for this time of year.

Naval air station, San Diego, Calif. (Sanitary report for January 1937).—During the past month there was a decided rise in the admission rate for influenza, but at no time did the situation reach an epidemic stage. Onset of disease appeared to be severe and rapid but of short duration. Average duration on sick list, 3 days. By the latter part of January the admission rate had dropped to a normal point.

Naval training station, Norfolk, Va. (Sanitary report for January 1937).—In the early part of the month there was a sudden influx of admissions to the sick list, chiefly from the recruit units, of men suffering with fever of varying intensity and a general feeling of lassitude, extreme in certain cases. Those admissions that presented a low white blood cell count (leukopenia) with severe prostration, out of proportion to the catarrhal symptoms, and with other symptoms suggestive of the disease, were classed as influenza and the remaining admissions designated as acute catarrhal fever. It will be appreciated that this distinction is difficult to follow in many admissions but with the disease highly prevalent in the surrounding civilian area it is firmly believed that all cases admitted as such were undoubtedly influenza. Seventeen of the total number of admissions showed signs of possible chest involvement and were immediately upon presentation of symptoms transferred to the naval hospital under diagnosis undetermined and the type of possible pneumonia indicated. All of the above cases developed pneumonia after hospital admission and all except one had comparatively mild attacks. The exception was a recruit mess attendant who reported at the sick bay with pneumonia already present and was immediately transferred to the hospital due to the lack of adequate facilities for nursing the seriously sick at this station. There were no fatalities. The early transfer of possible pneumonia is again emphasized and the wisdom of the procedure is borne out by these statistics, limited as they are.

There was a marked reduction in admissions for acute catarrhal fever and influenza at this station during February and a still further reduction in March.

Naval training station, Newport, R. I. (Report dated Jan. 11, 1937).—The morning sick reports between January 6 and 11 showed the following admissions for acute upper respiratory infections:

<i>Admissions</i>		<i>Admissions</i>	
Jan. 6_____	7	Jan. 9_____	19
Jan. 7_____	23	Jan. 10_____	17
Jan. 8_____	17	Jan. 11_____	15

Cases were transferred to hospital with the diagnosis of influenza, as follows:

<i>Admissions</i>		<i>Admissions</i>	
Jan. 8_____	9	Jan. 10_____	10
Jan. 9_____	18	Jan. 11_____	7

Their signs and symptoms were similar: Fever 102° F. to 103.6° F., pulse accelerated, respiration accelerated, pharyngitis, laryngitis, cough, rales in chest, prostration, pain over whole body, scanty urine, excessive perspiration, and leukopenia.

None of the cases had pneumonia. Two had severe mental depression. From the suddenness of the onset, the large number of those taken ill, the prostration, the leukopenia, and the fever, it is considered that influenza is epidemic at this station. The epidemic is not severe and appears to be subsiding.

Naval hospital, Great Lakes, Ill. (Report dated Jan. 25, 1937).—An outbreak of illness of the common cold and gripe type recently occurred on the United States naval training station and naval hospital, Great Lakes, Ill. At the same time similar epidemic conditions were reported from a large section of the country. The number of patients admitted to this hospital on each day of the epidemic is indicated below:

<i>Admissions</i>		<i>Admissions</i>	
Dec. 28, 1936.....	1	Jan. 7, 1937.....	14
Dec. 29, 1936.....	1	Jan. 8, 1937.....	18
Dec. 30, 1936.....	4	Jan. 9, 1937.....	1
Dec. 31, 1936.....	4	Jan. 10, 1937.....	1
Jan. 1, 1937.....	0	Jan. 11, 1937.....	4
Jan. 2, 1937.....	4	Jan. 12, 1937.....	0
Jan. 3, 1937.....	10	Jan. 13, 1937.....	1
Jan. 4, 1937.....	18	Jan. 22, 1937.....	1
Jan. 5, 1937.....	14		
Jan. 6, 1937.....	19	Total.....	115

In the presence of an epidemic of this sort it is known that certain commands tend to report such admissions as catarrhal fever, acute, while other neighboring units will report their cases as influenza. A certain small number of medical officers tend to favor such diagnoses as pharyngitis, laryngitis, and bronchitis.

With the thought of seeking data that might throw some light on the problem of differential diagnosis, a comparative study was made of all patients showing leukocyte counts in excess of 10,000, or below 5,000. The result seems to be mostly of negative value.

Follow up daily leukocyte counts were made of two patients, one with an initial leukocyte count of 10,550, the other 5,550. The findings were as follows:

	First	Second		First	Second
Jan. 13, 1937.....	10,550	5,550	Jan. 18, 1937.....	6,800	7,800
Jan. 14, 1937.....	9,750	4,700	Jan. 19, 1937.....	7,150	9,250
Jan. 15, 1937.....	8,400	6,700	Jan. 20, 1937.....	7,000	9,800
Jan. 16, 1937.....	11,400	6,900	Jan. 21, 1937.....	7,000	8,500
Jan. 17, 1937.....	7,400	7,500	Jan. 22, 1937.....	7,660	9,500

¹ No clinical signs or symptoms of any relapse or complication to account for this change in blood count.

One finding of interest was the high band form count in some of the cases. Another interesting fact was that during the outbreak unseasonably warm and damp weather prevailed. A change to freezing temperature, with dry clear weather, was accompanied by a drop in admissions to one on the day following the change in weather conditions.

Forces afloat reported 4,216 admissions for respiratory diseases during the first quarter, as compared with 3,605 admissions for the corresponding quarter of 1936. Catarrhal fever was responsible for 3,306 of the admissions. Ships reporting the largest numbers of cases were:

Ship	January	February	March	Total
U. S. S. Wyoming.....	172	18	15	205
U. S. S. Saratoga (Fleet air detachment).....	136	39	21	196
U. S. S. Lexington.....	93	13	11	117
U. S. S. Oklahoma.....	72	17	15	104
U. S. S. Arizona.....	79	14	8	101
U. S. S. Idaho.....	71	13	7	91
U. S. S. Raleigh.....	78	5	6	89
U. S. S. New Mexico.....	68	7	7	82
U. S. S. Pennsylvania.....	61	12	8	81
U. S. S. Saratoga.....	54	14	10	78
U. S. S. Tennessee.....	60	12	4	76
U. S. S. San Francisco.....	69	5	2	76
U. S. S. Henderson.....	58	6	10	74
U. S. S. Maryland.....	64	6	4	74
U. S. S. West Virginia.....	51	16	0	67
U. S. S. Holland.....	63	1	1	65
U. S. S. Indianapolis.....	65	0	0	65
U. S. S. Medusa.....	52	7	3	62
U. S. S. Portland.....	42	13	3	58
U. S. S. Pensacola.....	33	13	4	50
U. S. S. California.....	42	7	0	49
U. S. S. Quincy.....	41	2	5	48
U. S. S. Salt Lake City.....	40	3	5	48
U. S. S. Arkansas.....	26	11	9	46
U. S. S. Chaumont.....	37	4	3	44
U. S. S. Mississippi.....	30	6	6	42
U. S. S. Astoria.....	25	10	6	41
U. S. S. Trenton.....	32	3	6	41
U. S. S. Utah.....	30	8	3	41
U. S. S. Ranger.....	32	7	1	40
U. S. S. Kane.....	30	4	5	39
U. S. S. Tuscaloosa.....	33	4	2	39

The senior medical officers of the U. S. S. *Raleigh*, U. S. S. *Kane*, and U. S. S. *Wyoming*, commented as follows regarding outbreaks aboard these ships:

U. S. S. "Raleigh" (enroute to Naples, Italy).—During January 1937 there were 78 admissions for catarrhal fever. Seventy-five of the cases were discharged with a total of 248 sick days, an average of 3.3 sick days per case. Sixteen additional cases were admitted for 24 hours or less, giving a total incidence of 94 cases, 17.4 percent of the total complement. Otitis, media, acute, complicated one case, which cleared up without incident. Catarrhal fever is prevalent in the Mediterranean area. No infection has been seen, and so far as can be ascertained, is not prevalent ashore.

U. S. S. "Kane" (Gibraltar, B. P., Jan. 19, 1937).—An epidemic of acute respiratory infections began on January 15, 1937. All cases to date have been diagnosed catarrhal fever, acute. There were three admissions during the 2 weeks prior to January 15 and 16 subsequent admissions, as follows: January 15, one; January 16, two; January 17, six; January 18, four; and January 19, three. The vessel left Villefranche, France, on January 11 and arrived at Gibraltar on January 15. There were no prodromata, the initial symptoms being elevation of temperature, mild prostration, rhinitis, or pharyngitis. No pulmonary complications were noted. White blood counts were consistently low (5,000 to 6,500) with normal percentages of cells. The temperature range was 99° F. to 102° F. except in three cases which reached 103° F. and in one case which reached 105° F. for a few hours. The health authorities ashore were interviewed and stated that our shore privileges would not be restricted because there were a number of cases of "flu" in Gibraltar. The outbreak was confined to the after sleeping compartment and the personnel in this compartment restricted to the ship. A quarantine was imposed prohibiting visiting between the after and forward sleeping compartments. Nasal sprays of silvol 5 percent

and pharyngeal sprays of Dobell's solution were given to the entire personnel as a prophylactic measure. The milder cases became symptom-free in a few days.

U. S. S. "Wyoming" (Balboa, Canal Zone, to San Diego, Calif., Jan. 19, 1937).—The following data shows the daily admissions from members of the crew and members of the Fleet Marine Force, and the total number sent to duty each day:

Date	Admissions			To duty	Itinerary
	Crew	Fleet Marine Force	Total		
Jan. 1, 1937.....	1	-----	1	0	At Norfolk, Va.
Jan. 2, 1937.....	2	-----	2	0	Do.
Jan. 3, 1937.....	4	-----	4	0	Do.
Jan. 4, 1937.....	2	(1)	2	0	Do.
Jan. 5, 1937.....	1	3	4	0	At sea.
Jan. 6, 1937.....	2	1	3	4	Do.
Jan. 7, 1937.....	20	3	23	2	Do.
Jan. 8, 1937.....	17	21	38	6	Do.
Jan. 9, 1937.....	11	15	26	10	Do.
Jan. 10, 1937.....	14	7	21	16	Do.
Jan. 11, 1937.....	9	5	14	35	Canal Zone.
Jan. 12, 1937.....	5	2	7	15	Do.
Jan. 13, 1937.....	2	1	3	34	Do.
Jan. 14, 1937.....	5	2	7	11	Do.
Jan. 15, 1937.....	3	4	7	5	At sea.
Jan. 16, 1937.....	3	1	4	10	Do.
Jan. 17, 1937.....	0	0	0	6	Do.
Jan. 18, 1937.....	0	0	0	7	Do.
Total.....	101	65	166	161	

¹ Embarked.

The case admitted on January 1 had reported aboard for duty on December 31, 1936, from the receiving ship, New York, N. Y. He gave no information of feeling ill prior to date of admission. Of the two cases admitted on January 2, one had reported aboard for duty on that date from the *U. S. S. Arkansas* and was admitted to the sick list in the afternoon. The other case was a member of the ship's crew who had been aboard for some time. Of the four cases admitted on January 3, two were members of the ship's crew who had been aboard for some time; one had reported aboard for duty from the *U. S. S. Arkansas* on January 2; and one had reported aboard for duty on January 3 from the receiving ship, New York, N. Y., and was admitted to the sick list immediately. The patient stated that he became ill while en route to this vessel. The Fleet Marine Force embarked on January 4 and on January 5 the ship sailed from Norfolk, Va., for San Diego, Calif. Such sanitary and hygienic measures as were considered necessary for controlling the spread were immediately instituted. The peak of admissions from members of the crew was reached on January 7, while the peak of admissions from members of the Fleet Marine Force was reached the following day, January 8. From January 8 until January 17 the number of admissions gradually decreased until no admissions were recorded on January 17 and 18. No complications occurred in any of the cases treated. During the peak of the outbreak the sick bay was expanded to include the after living spaces on the port and starboard sides.

U. S. S. "Selfridge" (Genoa, Italy, Feb. 12, 1937).—There were 19 admissions over a period of 1 week. These cases were of a mild nature and hospitalization required but a few days.

STATISTICS

HEALTH OF THE NAVY

The following tables are summaries of morbidity rates per 1,000 for the first quarter of 1937 in comparison with rates for the corresponding quarter of the preceding 5 years:

ENTIRE NAVY

Year	All diseases	Injuries	Poisonings	All causes	Communicable diseases		Venereal diseases
					A	B	
1932.....	428	37	0. 07	465	(1)	(1)	125
1933.....	319	35	. 44	354	(1)	(1)	92
1934.....	405	55	. 75	461	13	118	88
1935.....	428	62	. 65	490	21	147	90
1936.....	335	42	. 34	377	10	130	45
1937.....	413	27	2. 47	443	32	201	59

FORCES ASHORE

1932.....	407	37	0. 10	444	(1)	(1)	75
1933.....	369	36	. 72	405	(1)	(1)	50
1934.....	537	61	. 47	598	22	182	54
1935.....	505	66	1. 14	572	41	191	50
1936.....	441	47	. 65	488	12	188	29
1937.....	493	25	. 36	519	50	272	33

FORCES AFLOAT

1932.....	440	36	0. 06	476	(1)	(1)	152
1933.....	292	35	. 29	326	(1)	(1)	116
1934.....	342	53	. 89	396	8	87	105
1935.....	386	60	. 38	447	11	124	111
1936.....	285	40	. 17	326	9	100	56
1937.....	370	28	3. 61	402	22	162	73

(1) Not available.

Common infectious diseases of the respiratory type.—There were a total of 8,068 admissions reported from the entire Navy during the first quarter of the year 1937, indicating a 21-percent increase from the number of cases notified for the corresponding quarter of 1936. Catarrhal fever was responsible for 5,772 of the total admissions. (For a detailed discussion of the incidence of these diseases during the quarter, see p. 545.)

Scarlet fever.—One case of scarlet fever was reported in February from the U. S. S. *Schenck* and one case in March from the U. S. S. *Mindanao*.

Chickenpox.—Twenty-three cases of chickenpox were reported for the quarter as follows: In January, one each from the navy yard, Philadelphia, Pa.; naval training station, Norfolk, Va.; Marine Corps base, San Diego, Calif.; U. S. S. *Henderson*, and the U. S. S.

Nokomis; in February, two each from the U. S. S. *Henderson* and the U. S. S. *Maryland*, and one each from the U. S. S. *Saratoga* (fleet air detachment) and U. S. S. *Sagamore*; and in March, three from the U. S. S. *Sacramento* and one each from the naval training station, Great Lakes, Ill., U. S. S. *Saratoga* (fleet air detachment), U. S. S. *Bainbridge*, U. S. S. *Claxton*, U. S. S. *Sacramento*, and the U. S. S. *Trenton*.

Cerebrospinal fever and meningitis, cerebrospinal, acute.—Thirteen cases of cerebrospinal fever were reported during January, February, and March 1937, as follows:

Rate	Age	Place of original admission	Date of admission	Length of service (years)	Disposition
Sea. 2c.....	22	U. S. S. <i>Texas</i>	Jan. 9, 1937	9½	Discharged Feb. 26, 1937.
A. S.....	19	Naval training station, Newport, R. I.	Jan. 18, 1937	½	Died Feb. 9, 1937.
F. 2c.....	22	U. S. S. <i>Trenton</i>	Jan. 13, 1937	1½	Died Jan. 14, 1937.
Pvt.....	19	U. S. S. <i>New Mexico</i>	Jan. 15, 1937	½	Discharged Feb. 26, 1937.
Sea. 2c.....	22	U. S. S. <i>Nevada</i>	Jan. 9, 1937	½	(1)
Sea. 2c.....	20	do.....	Jan. 22, 1937	2½	(1)
Pvt.....	24	Marine barracks, Quantico, Va.	Feb. 22, 1937	1½	Died Feb. 24, 1937.
B. M. 2c.....	34	U. S. S. <i>Minneapolis</i>	Feb. 10, 1937	13½	Discharged Apr. 9, 1937.
Cox.....	26	U. S. S. <i>Vestal</i>	Feb. 9, 1937	7½	Discharged Mar. 19, 1937.
Pvt.....	23	Marine barracks, Quantico, Va.	Feb. 22, 1937	3½	(1)
Sea. 2c.....	20	U. S. S. <i>Nevada</i>	Feb. 24, 1937	10½	(1)
Sea. 2c.....	20	U. S. S. <i>Arizona</i>	Mar. 1, 1937	1½	Discharged Apr. 9, 1937.
W. T. 1c.....	31	U. S. S. <i>Pinola</i>	Mar. 19, 1937	12½	Discharged Apr. 14, 1937.

1 Not known at this time.

One case of meningitis, cerebrospinal, acute, was admitted in March at the Navy Yard, Portsmouth, N. H. This disease was also reported as the secondary cause of one death on board the U. S. S. *Moffett*, osteomyelitis, maxillary and frontal, being the primary cause.

Mumps.—One hundred and four cases of mumps were reported for the quarter. The United States naval training station, Great Lakes, Ill., reported 21 cases in January, 10 in February, and 10 in March; the United States naval training station, Norfolk, Va., 14; the United States naval training station, Newport, R. I., and the United States naval training station, San Diego, Calif., 5 each; U. S. S. *Arkansas*, U. S. S. *J. Fred Talbott*, and the U. S. S. *Mississippi*, 3 each; U. S. S. *Chandler*, U. S. S. *Palos*, U. S. S. *Saratoga* (fleet air detachment), U. S. S. *Texas*, and the submarine base, New London, Conn., 2 each; and 1 each from 18 ships and 5 shore stations.

In reporting the occurrence of mumps on board the U. S. S. *Omaha* the senior medical officer commented as follows: The first case of mumps occurred on December 18, 1936. From the period January 4, 1937, to January 20, 1937, 14 cases with a diagnosis of mumps and 6 with diagnosis undetermined (mumps) were admitted and transferred the same date, to the dispensary, United States submarine

base, Coco Solo, Canal Zone. Two additional cases occurred, the first on January 26, 1937, and the second on January 28, 1937. These cases are being transferred upon arrival of this vessel in Balboa, Canal Zone.

United States submarine base, Coco Solo, Canal Zone. (Monthly sanitary report for January 1937).—On January 4, 1937, one case of mumps was admitted from U. S. S. *Omaha*, the original infection apparently contracted in the city of Panama. During the month 24 cases were admitted from the U. S. S. *Omaha* and one from this base. The cases were mild and with few complications.

German measles.—The fourth Marines, Shanghai, China, reported 1 case of German measles in January, 8 in February, and 13 in March.

Typhoid fever.—An officer, 50 years of age, with 15½ years' service, was admitted February 12, 1937, to the naval station, Guam, with typhoid fever. No questionnaire has been received in the Bureau for this case, consequently no information is available regarding prophylaxis. A fatal case of typhoid fever was admitted on board the U. S. S. *Black Hawk* on December 27, 1936, and died at the United States naval hospital, Canacao, Philippine Islands, on January 1, 1937. Two complete courses of typhoid prophylaxis had been completed; one in April 1929 and one in May 1933.

Paratyphoid fever.—A seaman, first class, 20 years of age, with 3½ years' service, was admitted to the sick list at the fleet air base, Pearl Harbor, Territory of Hawaii, on March 12 and discharged on May 11, 1937, with paratyphoid fever A. The case was moderately severe without complications. The place and source of infection are unknown, but the questionnaire contained a statement that "sporadic cases of paratyphoid have been present in Honolulu, Territory of Hawaii." Information regarding prophylaxis was not available at the United States naval hospital, Pearl Harbor, Territory of Hawaii, when questionnaire was completed.

Summary of morbidity in the U. S. Navy for the quarter ending Mar. 31, 1937

Average strength	Forces afloat, 83,071		Forces ashore, 44,727		Entire Navy, 127,798	
	Admis- sions	Rate per 1,000	Admis- sions	Rate per 1,000	Admis- sions	Rate per 1,000
All causes.....	8,339	401.54	5,804	519.06	14,143	442.67
Disease only.....	7,685	370.05	5,517	493.39	13,202	413.21
Injuries.....	579	27.88	283	25.31	862	26.98
Poisonings.....	75	3.61	4	.36	79	2.47
Communicable diseases transmissible by oral and nasal discharges (class VIII):						
(A).....	462	22.25	554	49.54	1,016	31.80
(B).....	3,373	162.42	3,038	271.69	6,411	200.66
Veneral diseases.....	1,518	73.09	368	32.91	1,886	59.03

DEATHS

DURING THE QUARTER ENDED MARCH 31, 1937

Cause—		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Average strength.....		9,683	2,247	97,594	1,313	16,568	393	127,798
DISEASES								
Anaphylaxis (anti-pneumococcus serum).....	Pneumonia, lobar.....			1				1
Calculus, renal.....	Abscess, perinephretic.....			1				1
Carbuncle, lip.....	Septicemia.....			1				1
Cardiac arrhythmia, auricular fibrillation.....	None.....			1				1
Cerebrospinal fever.....	None.....			2		1		3
Cholecystitis, chronic.....	Obstruction, intestinal, from spastic or paralytic causes.....					1		1
Dysentery, bacillary.....	Pericarditis.....			1				1
Gonococcus infection.....	Endocarditis, acute ulcerative (malignant).....			1				1
Influenza.....	Encephalitis, acute.....					1		1
Do.....	Pneumonia, lobar.....	1						1
Myocarditis, chronic.....	None.....			1				1
Osteomyelitis, maxillary and frontal.....	Meningitis, cerebrospinal acute.....			1				1
Pneumonia, lobar.....	None.....			5			1	2
Sarcoma.....	None.....			2				1
Syphilis.....	Valvular heart disease aortic insufficiency.....			1				6
Thrombosis, coronary artery.....	None.....	1		1	1	1		4
Tonsillitis, acute.....	Pneumonia, broncho.....			1				1
Tumor, malignant, mixed (adenocarcinoma).....	None.....	1		1				2
Tumor, malignant, mixed (fibrosarcoma) retroperitoneal.....	None.....			1				1
Tumor, malignant, mixed (spongioblastoma) cerebrum.....	None.....			1				1
Tumor, malignant, mixed, (teratoma) testes.....	None.....			1				1
Typhoid fever.....	None.....			1				1
Ulcer, duodenum.....	Abscess, subphrenic.....			1				1
Do.....	Pleurisy, suppurative.....			1				1
Total for disease.....		3		27	1	4	1	36
INJURIES AND POISONINGS								
Crush, skull.....	None.....			1				1
Drowning.....	do.....			4				4
Fracture, compound, skull.....	do.....			1				1
Do.....	Intracranial injury.....					2		2
Do.....	Pneumocephalus, traumatic.....			1				1
Fracture, simple, skull.....	None.....	1		2				3
Do.....	Intracranial injury.....			1				1
Hemorrhage, traumatic, thoracic, and abdominal cavities.....	None.....					1		1
Injuries, multiple, extreme.....	do.....	4		8	1	6		19
Intracranial injury.....	do.....			1		1		2
Wound, gunshot, head.....	do.....	2		2				4
Wound, punctured, abdomen.....	Pneumonia, lobar.....				1			1
Poisoning, acute:								
Barbituric acid.....	None.....					1		1
Carbon monoxide.....	do.....					1		1
Mercurial compound.....	do.....			1				1
Total for injuries and poisonings.....		7		22	2	12		43
Grand total.....		10		49	3	16	1	79

DURING THE QUARTER ENDED MARCH 31, 1937—Continued

Cause—		Navy			Marine Corps		Nurse Corps	Total
Primary	Secondary or contributory	Officers	Midshipmen	Men	Officers	Men		
Annual death rate per 1,000:								
All causes.....		4.13		2.01	9.14	3.86	10.18	2.47
Disease only.....		1.24		1.10	3.05	.97	10.18	1.12
Drowning.....				.16				.13
Poisonings.....				.04		.48		.09
Other injuries.....		2.89		.70	6.09	2.41		1.13

ADMISSIONS FOR INJURIES AND POISONINGS, FIRST QUARTER, 1937

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the first quarter 1937, is based upon all form F cards covering admission in those months which have reached the Bureau:

	Admissions January, February, and March 1937	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1936
<i>Injuries</i>			
Connected with work or drill.....	412	1,290	2,513
Occurring within command but not associated with work.....	273	854	1,924
Incurred on leave or liberty or while absent without leave.....	177	554	1,760
All injuries.....	862	2,698	6,197
<i>Poisonings</i>			
Industrial poisoning.....	0	0	7
Occurring within command but not connected with work.....	76	238	211
Associated with leave, liberty, or absence without leave.....	3	9	18
Poisonings, all forms.....	79	247	236
Total injuries and poisonings.....	941	2,945	6,434

Percentage relationships

	Occurring within command				Occurring outside command—leave, liberty, or A. W. O. L.	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	January, February, and March 1937	Year 1936	January, February, and March 1937	Year 1936	January, February, and March 1937	Year 1936
Percent of all injuries.....	47.8	40.6	31.7	31.0	20.5	28.4
Percent of all poisonings.....	0	3.1	96.2	89.5	3.8	7.5
Percent of total admissions, injury and poisoning titles.....	43.8	39.2	37.1	33.2	19.1	27.6

NOTE.—Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism", as the case may be. Such cases are not included in the above figures. There were no cases during the first quarter of 1937 worthy of notice from the standpoint of accident prevention.

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following statistics were taken from sanitary reports submitted by naval training stations:

January, February, and March 1937	United States naval training station—			
	Norfolk, Va.	Newport R. I.	Great Lakes, Ill.	San Diego, Calif.
Recruits received during the period.....	962	644	618	1,430
Recruits appearing before Board of Medical Survey.....	4	0	3	0
Recruits recommended for discharge from the service.....	4	0	3	0
Recruits discharged by reason of medical survey.....	4	0	0	0
Recruits held over pending further observation.....	0	0	0	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment..	1	19	66	68

The following table was prepared from reports of medical surveys in which disabilities or disease causing the surveys were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Abscess, acquired, teeth.....	1	Gonococcus infection, osteoperiostitis os	
Acne, simple.....	1	calcis.....	1
Acne, vulgaris.....	1	Gonococcus infection, urethra.....	1
Anomaly of form (trunk and legs).....	1	Hernia, inguinal.....	4
Arterial hypertension.....	5	Ingrowing nail.....	1
Asthma.....	1	Malformation, congenital.....	3
Caries, teeth.....	2	Myopia.....	2
Congenital heart disease.....	1	Opacity, vitreous humor.....	1
Constitutional psychopathic inferiority, without psychosis.....	4	Otitis, media, chronic.....	5
Constitutional psychopathic state, inadequate personality.....	2	Pes cavus.....	1
Curvature, spine (lateral).....	1	Psychoneurosis, hysteria.....	1
Deafness, unilateral.....	1	Psychoneurosis, neurasthenia.....	1
Deafness, bilateral.....	1	Psychoneurosis, psychasthenia.....	1
Defective physical development.....	1	Psychoneurosis, unclassified, anxiety neurosis.....	1
Deformity, acquired, loss of flexion, right index finger.....	1	Pyorrhea alveolaris.....	2
Deformity, acquired, shortened left femur.....	1	Somnambulism.....	3
Dementia praecox.....	3	Strabismus.....	2
Effort syndrome.....	1	Syphilis.....	3
Enuresis.....	4	Thrombo-angitis, obliterans.....	1
Epilepsy.....	4	Ulcer, duodenum.....	1
Flat foot.....	11	Valvular heart disease, mitral insufficiency.....	1
Genu valgum.....	2	Valvular heart disease, mitral stenosis.....	4
		Valvular heart disease, pulmonic lesion.....	1
		Varicocele.....	2

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME XXXII

INDEX TO SUBJECTS

	Page
Abscess, peritonsillar, therapy.....	339
Adenocarcinoma, caecum.....	253
Advances in medicine, 1936.....	281
Agranulocytosis.....	484
Air pressure, increased, reactions to.....	373
American Board of Otolaryngology.....	268, 502
American College of Physicians.....	96, 500
American College of Surgeons.....	96, 498
American Neisserian Medical Society.....	267
Appendicitis, the Navy and.....	41
Arsenicals:	
Toxic effects of.....	111, 517
Toxic effect, clinical evidence.....	263
Arsenoxide, estimates of.....	207
Arteries, peripheral diseases.....	309
Articles of special merit, 1936.....	351
Artificial respiration:	
Comparison methods.....	60, 496
Relation to carbon dioxide.....	380
Association, Military Surgeons, annual meeting.....	352
Atabrine, treatment, malaria.....	418
Aviation medicine.....	55
Bates, Newton L.....	493
Book notices.....	101, 269, 353, 507
Burns, treatment, new methods.....	264
Brown, John Mills.....	261
Caecum, adenocarcinoma of.....	253
Cancer, penis.....	473
Carbon dioxide, relation to artificial respiration.....	380
Case for diagnosis.....	81, 96
Certificate of merit, Navy exhibit.....	494
Chancre:	
Extra-genital.....	470
Physician's.....	469
Clavicle, fracture.....	343
Clinical notes.....	81, 253, 329, 469
Compressed-air illness, oxygen treatment of.....	61
Control of syphilis and gonorrhoea.....	97

	Page
Copper sulphate, treatment, trichophytosis.....	440
Delinquency, United States Navy.....	157
Dementia pugilistica.....	297
Dentition, abnormal.....	344
Dientamoeba, fragilis.....	496
Digest of treatment.....	505
Divers, decompressing of.....	219
Diverticulum, stomach.....	480
Endocrinology, concepts of:	
Part 1.....	8
Part 2.....	176
Part 3.....	387
Ergot, active principle.....	266
First-aid emergency outfit for destroyers.....	87
Flying trainee, selection of.....	434
Food poisoning.....	148, 365, 541
Fractures:	
Clavicle.....	343
Pathological.....	73
Glycerine, use.....	351
Gunnell, Francis M.....	85
Health of the Navy—statistics.....	150, 285, 367, 550
Hepatitis, acute.....	446
Human machine, in diving.....	502
Hyperthermia for gonorrhoea ophthalmia.....	472
Infectious diseases, common, respiratory.....	545
Influenza.....	504
Insecticides.....	303
Iso-elixir.....	98
Lead, detection in body fluids.....	99
Leptomeningitis, spinal staphylococcus.....	329
Lymphedema, extremities.....	196
Lymphopathia, venereum.....	331
Malaria, treatment.....	418
Medico-Military Symposium, Eighth Annual.....	89
Mental and neuro-muscular, reactions to increased air pressure.....	373
Military Surgeons' Convention.....	501
Mosquito control.....	144
Naval Reserve.....	89, 259, 347, 491
Naval surgeon versus specialist.....	52
Navy exhibit, A. M. A. convention.....	494
New devices.....	87, 489
Nitrogen elimination, measurements of.....	219
Notes and comments.....	95, 261, 349, 493
Obstruction, intestinal, roundworms.....	482
Olive oil as an antidote.....	98
Ophthalmia, gonorrhoeal.....	472
Oral diagnosis.....	441
Oxygen treatment, compressed-air illness.....	61
Peptic ulcer, treatment.....	460
Percentage solutions.....	503

	Page
Phenol poisoning, antidote.....	98
Plasmochin, treatment, malaria.....	418
Pneumococcus, serum, therapy.....	339
Polson antidote box.....	489
Poisoning, sodium fluoride.....	255
Preventive medicine.....	111, 285, 357, 517
Psychiatric cases, diagnosis and treatment.....	224
Recruits, statistics, mental and physical qualifications.....	556
Reality adjustment, flying trainee.....	434
Renal dystopia.....	258
Sarcoma, skin.....	85
Seasickness.....	293
Seasickness, research.....	266
Septicemia, pneumococcus, therapy.....	339
Shoe measuring devices.....	149
Sodium fluoride, poisoning.....	255
Sprue, liver therapy.....	497
Stomach, diverticulum.....	480
Surgeons General:	
Bates.....	498
Brown.....	261
Grunnell.....	95
Tryon.....	349
Surgical shock.....	428
Swains Island, sanitary report, 1934.....	357
Syphilis:	
A study of.....	450
Census literature.....	263
Immunity in.....	173
Reinfections, analysis of.....	240
Tetanus toxoid, active immunization against.....	33
Tracheobronchitis.....	99
Trachoma.....	322
Trichinosis:	
Precipitin test.....	352
Two cases.....	475
Trichophytosis, treatment.....	440
Tryon, James Rufus.....	349
Tuberculosis, voles.....	498
Tumor, glomic malignant.....	85
United States Naval Medical Bulletin, bound sets.....	265
Venereal disease:	
Trend of, United States Fleet.....	1
U S. S. <i>Pennsylvania</i>	542
Vision, effect of fatigue.....	497
Wassermann, provocative, caution.....	263
Water supply, Guam.....	535
Wellcome medal and prize.....	267

INDEX TO AUTHORS

	Page		Page
Allen, Edgar V.....	196, 309	McCartney, James L.....	244
Austin, T. R.....	426	Melhorn, K. C.....	1
Baker, R. E.....	343	Millsbaugh, J. A.....	240, 297
Ball, C. R.....	418	Moloney, J. V.....	440
Behnke, Albert R.....	61, 219	Norman, Irwin L.....	196, 309
Blackwood, J. D.....	489	Parsons, R. P.....	207
Blew, C. L.....	484	Phillips, Richard B.....	89
Boone, Horace R.....	41	Prehn, D. F.....	450
Bowman, Foster H.....	73	Ricen, Edgar.....	460
Brown, Omar J.....	8, 176, 387	Richmond, Paul.....	480
Butler, C. S.....	6	Rizk, W. S.....	331
Camerer, C. B.....	87	Roddie, Louis H.....	493
Cammissa, J. J. V.....	339	Sargent, W. S.....	473, 482
Cole, O. W.....	322	Schantz, C. W.....	441
Cottle, G. F.....	52	Shackford, B. C.....	460
Cozby, H. O.....	157	Shaw, Louis A.....	61
Dickens, Paul F.....	8, 176, 387	Shilling, C. W.....	373
Dudley, H. Z.....	87	Soiland, Albert.....	85
Hall, W. W.....	33	Stelle, C. W.....	470
Hawkins, J. A.....	60	Stephenson, C. O.....	111, 285, 357, 517
Hays, Thomas G.....	253	Terry, Jack.....	472
Hoyt, C. F.....	344	Vann, John W.....	55
Humphreys, Lincoln.....	293	Wade, E. M.....	329
Johnson, F. S.....	60, 303	Wells, J. J.....	475
Johnson, Lucius W.....	41	Willgrube, W. W.....	373
Joses, Maurice.....	475	Wirthlin, M. R.....	255
Love, Julian.....	446	Yarbrough, O. D.....	60

